STUDIES IN THE APOCYNACEAE. III

A Monograph of the Genus Amsonia

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Historical Discussion

When the second edition of Linnaeus's 'Species Plantarum' appeared in 1762, one of the many additions to the species presented in the first edition (1753) was *Tabernaemontana Amsonia*,[1] a plant the exact genus of which Linnaeus himself was not precisely sure, qualifying it to the genus *Tabernaemontana* with the remark "Affinis Camerariae et Tabernaemontanae." The attitude with which Linnaeus treated his *Tabernaemontana Amsonia* is essayed by Sir J. E. Smith,[2] and throws much illumination upon problems concerning the genus which will receive subsequent treatment in this monograph: "Tabernaemontana ——. The herbaceous plants, supposed by Linnaeus to belong to this genus, constitute, as we have already said, and as Linnaeus himself originally thought, a very distinct one, of which we shall now treat by the name of Amsonia. We can give no positive account of the meaning or origin of this word except that its author, according to Miller,[3] was Clayton. Linnaeus in his own copy of Gronovius' Flora Virginica, ed. 1. p. 26, has written *Amsonia* as a generic name, to what Clayton took for a species of *Nerium*, and has subjoined also in manuscript the characters of the follicles and seeds. This plant, in the second edition of the Species Plantarum, is the *T. Amsonia;* and so it remained until Mr. Walter restored it to rank as a genus; but without throwing any light upon the name."

The name *Amsonia* has indeed been an enigma, and Rafin-

[1] L. Sp. Pl. ed. 2, **2**: 301. 1762.
[2] Sm. in Rees, Cycl. **35**. 1819.
[3] Miller, Gard. Dict. ed. 5, **2²**: art. "Tabernaemontana." 1807.

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esque[1] even went so far as to change the name to "*Ansonia*," referring to the passage above quoted from Smith, and naively remarking that he had been acquainted with several Ansons, but never an Amson, and so the name must be misspelled.

With the fresh stimulus of Rafinesque's contention a special search was made for the origin of the name *Amsonia*, and for a time it appeared that Rafinesque's intuition had been well guided, for, although all of the published floras and manuals dealing with the genus spoke readily of "Dr. Amson, a colonial physician," or "Charles Amson, a physician of South Carolina," no authentic trace of that gentleman could be found, either in published encyclopedias or standard reference works. Historical societies in Virginia and the Carolinas were invoked to no avail. An Amson, any Amson whatever, was not forthcoming.

However, Ansons were frequent, including a certain Lord George Anson, a royal governor fond of explorative expeditions, from one of which he had discovered and brought to civilization a new esculent pea. Rafinesque was about to be vindicated, when a letter from Clayton to John Bartram appeared which seems to solve the problem, although not completely. The letter, which was written from Gloucester County, Virginia, Sept. 1, 1760, follows:

"Dear Friend:

"I have sent you, enclosed, some seed of a new plant, which I presume is a stranger in your northern part of the world. Indeed it grows here only in the southern parts of the colony. I have it in my garden, but have quite forgotten whether I showed it to you, when I had the favor of your company. If I did, I believe I told you it was to be called *Amsonia*, after a doctor, here; but I think the name inscribed upon the inclosed more proper, as it answers to the particular form of its seed.

"I intend to send you some of the seed of our thorny Sensitive Plant by the first opportunity that offers, after it is ripe;

"And remain, dear sir, your sincere friend

"And most most humble servant,

"John Clayton."

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[1] Raf. New Fl. N. Am. **4**: 58. 1838.

Allowing for orthographical errors, then, *Amsonia* was definitely named for a certain Dr. Amson, a physician of Gloucester Co., Virginia; but regarding his complete name, or the positive form of spelling of his family name, doubt still remains. Lord Anson, however, can undoubtedly be discarded as a possibility. The "name inscribed upon the inclosed," which Clayton thought to be "more proper," was evidently *Tabernaemontana Amsonia*.

Tabernaemontana Amsonia was immediately conspicuous among the other Tabernaemontanas both in habit and in habitat, since it was the only temperate herbaceous member of the genus, and in 1788 attracted the attention of Thomas Walter,[1] who described from it a new genus, naming the type species, in transposition of the Linnaean combination, *Amsonia Tabernaemontana*. At the same time, Walter[2] also described a new plant from the Carolinas which he assigned to the same new genus, calling it *A. ciliata*.

As a result of his explorations in the southeastern United States, André Michaux[3] was able to expand the little genus with the addition, in 1803, of two new species, *A. latifolia* and *A. angustifolia*. The latter was a transfer to *Amsonia* of a species placed in the genus *Tabernaemontana* by Aiton[4] in 1789. Pursh,[5] in 1814, also published a new species which he named *A. salicifolia*.

Probably the most interesting addition which has ever been made to the species of *Amsonia* was in 1819, when Roemer and Schultes[6] transferred to that genus a plant which had been assigned to *Tabernaemontana* by Thunberg[7] in 1784. The species, *A. elliptica*, was a native of Japan, and is yet the only known member of the genus not native to North America. Thunberg was slightly hesitant, as was Linnaeus, in committing his plant to the genus *Tabernaemontana*, but relied upon the precedence of the earlier author, remarking, much as did Lin-

[1] Walt. Fl. Carol. 98. 1788.
[2] Walt. *l. c.* 1788.
[3] Michx. Fl. Bor. Am. **1**: 121. 1803.
[4] Ait. Hort. Kew. **1**: 300. 1789.
[5] Pursh, Fl. Am. Sept. ed. 1, **1**: 184. 1814.
[6] Roem. & Schult. Syst. Veg. **4**: 432. 1819.
[7] Thunb. Fl. Jap. 111. 1784.

naeus, "Valde affinis Amsoniae," a significant statement in the light of the later disposition of the species.

The same year there appeared in the Rees 'Cyclopaedia' the description by Sir J. E. Smith[1] of a species of *Amsonia* which he called *A. tristis*. The plant was reported grown in an English garden from seed collected in North America by Lyon, who contributed the plant from which Pursh published his *A. salicifolia*. Smith gave to his plant the common name "brownish-flowered Amsonia," since, as he wrote, "The flowers . . . are of a dingy brown hue, the segments of their limb strongly reflexed, at least in fading." The species has not been reported since its publication, and because of the rather suspicious-sounding description of the flowers, the name has generally been referred to as a synonym of *A. Tabernaemontana* Walt., or of *A. salicifolia* Pursh.

Rafinesque's 'New Flora of North America' appeared in 1838, with a comparative sketch of the "Ansonias" then recognizable, and added one new species, *A. tenuifolia*,[2] the originality of which the author took unusual pains to indicate.

In the 'Prodromus' of De Candolle the genus *Amsonia* received its first collective treatment. Besides recognizing the species which had previously been published with the exception of *A. tenuifolia* Raf., Alphonse De Candolle[3] described a new plant which he termed *A. salicifolia* Pursh var. *ciliolata*, from Alabama and Louisiana. The following year the genus gave evidence of the growing botanical knowledge of the southwestern United States by the publication by Torrey and Frémont[4] of *A. tomentosa* from "west of the Rocky Mountains." Fourteen years later, as a result of the activities of the Mexican Boundary Survey, Torrey[5] published a second species, *A. longiflora*, a very distinct plant of the region about El Paso, Texas.

Some time later the genus came to the attention of Asa Gray during the course of the preparation of the 'Synoptical Flora,'

[1] Sm. in Rees, Cycl. **35**: end of art. "Tabernaemontana." 1819.
[2] Raf. New Fl. N. Am. **4**: 58. 1838.
[3] A. DC. in DC. Prodr. **8**: 384. 1844.
[4] Torr. & Frém. in Frém. Rept. 1843–1844, 316. 1845.
[5] Torr. in Rept. Mex. Bound. Surv. **2**[1]: 159. 1859.

and in 1877[1] he published two new species from the Southwest, *A. brevifolia* and *A. Palmeri*. The following year when the 'Synoptical Flora'[2] was issued, there appeared also a new variety of the genus which Gray termed *A. angustifolia* Michx. var. *Texana*. Besides being noteworthy for the contribution of a new variety, Gray's treatment of *Amsonia* in the 'Synoptical Flora' constitutes a scientific and comprehensive treatment of the group in its phylogenetic aspects.

In 1894, in accordance with the Rochester Code of Nomenclature, a double name was made by Britton[3] for the type species of the genus. This name, *Amsonia Amsonia*, is still current among some botanists.

K. Schumann,[4] in Engler and Prantl's 'Natürlichen Pflanzenfamilien,' elaborated upon Gray's treatment in the 'Synoptical Flora' and divided the genus into two sections which he called *Euamsonia* and *Sphinctosiphon*. In the first section, three species were recognized, namely, *A. Tabernaemontana* Walt., *A. ciliata* Walt., and *A. elliptica* (Thunb.) Roem. & Schult., and in the second section, four species, *A. Palmeri* Gray, *A. longiflora* Torr., *A. brevifolia* Gray, and *A. tomentosa* Torr. & Frém.

In the twentieth century numerous additions have been made to the genus *Amsonia*. In 1900 A. A. Heller[5] elevated Gray's *A. angustifolia* Michx. var. *Texana* to specific rank. In Small's 'Flora of the Southeastern United States' two new species are contained, *A. ludoviciana* Vail[6] and *A. rigida* Shuttleworth.[7] Other new specific contributions have been *A. latifolia* M. E. Jones,[8] 1908, *A. Eastwoodiana* Rydberg,[9] *A. arenaria* Standley,[10] and *A. hirtella* Standley,[11] in 1913. Jepson,[12] in 1925, reduced *A. tomentosa* Torr. to a variety of *A. brevifolia* Gray.

[1] Gray, Proc. Am. Acad. **12**: 64. 1877.
[2] Gray, Syn. Fl. N. Am. **2**[1]: 81. 1878.
[3] Britton, Mem. Torr. Bot. Club **5**: 262. 1894.
[4] K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. **4**[2]: 143. 1895.
[5] Heller, Muhlenbergia **1**: 2. 1900.
[6] Vail, in Small, Fl. Southeast. U. S. 935. 1903.
[7] Shuttlew. in Small, *l. c.* 1903.
[8] Jones, Contr. West. Bot. **12**: 50. 1908.
[9] Rydb. Bull. Torr. Bot. Club **40**: 465. 1913.
[10] Standl. Proc. Biol. Soc. Wash. **26**: 117. 1913.
[11] Standl. *l. c.* 1913.
[12] Jepson, Man. Fl. Pl. Cal. 768. 1925.

Evidently the first printed illustration of an *Amsonia* was one presumably of *A. Tabernaemontana* in Plukenet, *t. 115, fig. 3*, 1769, where it appears as "Apocynum Virginianum Asclepiadisfolio erectum floribus pallide caeruleis radici crassa."

Because of the peculiar distribution of the genus as well as because of its growing need for a taxonomical revision, it was thought appropriate that a rather broad study be made of the genus *Amsonia*. Such a study was begun at the Gray Herbarium of Harvard University under the oversight of Dr. B. L. Robinson and Prof. M. L. Fernald, and completed at the herbarium of the Missouri Botanical Garden under Dr. J. M. Greenman. To Professors Robinson, Greenman, and Fernald, the author wishes to express his obligations most heartily for their kindly criticism and their ready suggestions. To Mr. T. H. Kearney the author is also indebted for much valuable aid with regard to the difficult species of the southwestern United States. Various herbaria have been visited, also, or specimens have been borrowed, and to the curators of each the author would express his gratitude.

Gross Morphology

The genus *Amsonia* is one of the few members of the Apocynaceae which are temperate or subtemperate, and contains within its several species only erect perennial semi-woody herbs.

Roots.—The root system of the group is characteristically fibrous. The crowns usually become woody with increasing age, and produce numerous clustered stems. Latex tubes occur in abundance, as in all the members of the family.

Stems.—The stem system is typically that of an erect perennial and varies relatively little. A mature stem is usually divided into several branches. The species inhabiting the arid regions of the southwestern United States and northern Mexico frequently have stems which are branched to a much greater extent, and much lower upon the stem than the more temperate species of the states of the Southeast and Middle West.

Leaves.—The leaves of the genus are alternate to subverticillate, and vary greatly in size and outline. Through the succession of species, extremes are found in the leaves of *A. Tabernaemontana*, which are broadly ovate-elliptic, usually measur-

ing 3–5 cm. long and 1.5–2.5 cm. broad, petiolate and opposite, to the subverticillate leaves of *A. salpignantha*, which are linear-lanceolate to linear-filiform, measuring 2–5 cm. long and .5–4 mm. broad, and decidedly sessile. The leaves may also be glabrous to glaucous, as they are in *A. salicifolia*, or densely tomentose, as they occur in *A. tomentosa*. The leaves are always entire, and are never cordate. In only one species, *A. Tabernaemontana*, are the bases of the leaf-blades other than acute when a petiole exists.

Inflorescence.—The inflorescence is a thyrsoid or corymbose cyme. The amount and shape of the inflorescence, however, is varied. The largest inflorescence of the genus is found in *A. Tabernaemontana* var. *Gattingeri*, which frequently contains over fifty blossoms, and the smallest in *A. Palmeri*, which usually has only five or six. The inflorescence may have very inconspicuous bracteoles, as in the subgenus *Euamsonia*, or quite conspicuous bracteoles, giving the whole inflorescence a chaffy appearance, as in the subgenera *Sphinctosiphon* and *Articularia*. The inflorescence may also be surrounded by the foliage, as in *A. arenaria*, or held high above the foliage by a long, nearly leafless stalk, as in *A. ciliata* var. *tenuifolia*. Pedicels may be relatively long, as in *A. Tabernaemontana* var. *salicifolia*, or frequently lacking altogether, as in *A. longiflora*.

Calyx.—The variation in the calyx is marked. In *A. Tabernaemontana* var. *salicifolia* the calyx is 1 mm. long or less in entirety, the lobes being minutely triangular-ovate. In *A. tomentosa* the calyx is as shallow as in the former species, but the lobes are fully 3–5 mm. long and are subulate-aristate. The calyx may be glabrous or pubescent, occasionally becoming sparsely hirsute.

Corolla.—The corolla is regularly five-lobed. The tube dilates upward, and may be unconstricted, as in the subgenus *Euamsonia*, or markedly constricted at the mouth, as in the subgenera *Sphinctosiphon* and *Articularia*. Variation in the length of the tube is great, ranging from 6–8 mm. in *A. ciliata* var. *tenuifolia* and allied species, to 3–3.5 cm. in *A. longiflora* and *A. salpignantha*, which have the most conspicuous flowers of the genus. The color varies from a clear cerulean blue, tinged to tawny-white in the tube,

in most of the eastern species, to white or a faint livid greenish blue in some of the western species. The tube is always villous within, and may be pubescent or glabrous without. The lobes of the corolla are spreading, and may be ovate to narrowly lanceolate in outline. The length of the lobes varies from one-half the length of the tube to an equal length, save in the large-flowered species of the section *longiflorae* of the subgenus *Sphinctosiphon*, where the ratio of the length of the tube to that of the lobes may be from about 3 : 1 in *A. longiflora* to 5 : 1 in *A. salpignantha*.

Stamens.—The stamens number five, and are adnate to the corolla-tube well above the middle. The anthers are ovate-lanceolate, acute above, obtuse below, unappendaged, and fertile throughout their entire length. The stamens are free from the stigmatic-cap.

Pistil.—The two carpels of the gynoecium, which are uniloculate and contain many two-seriate anatropous ovules, are united by a common filiform style, which is about the length of the corolla-tube, to a position immediately below the stamens, where it is surmounted by a stigmatic-cap bearing the stigma. The stigmatic-cap is constructed in three elements, the lower of which is a reflexed membranaceous appendage, originating from the summit of the stylar shaft, the central, a tangled mass of short papillae, and the upper, the stigma itself, which may be depressed-capitate or truncate, as in the subgenus *Euamsonia*, or apiculate by two distinct obtuse lobes, as in the subgenera *Sphinctosiphon* and *Articularia*.

Fruit.—The fruit of *Amsonia* is a pair of follicles which are cylindrical and acuminate, and may be slender and continuous, as in the subgenera *Euamsonia* and *Sphinctosiphon* or torose and definitely articulated into thickish constricted segments, as in the subgenus *Articularia*. In either case the seeds are one-seriate, cylindrical, and unappendaged, but in *Articularia* the endosperm is conspicuously thicker and more corky than in the endosperm of the other subgenera.

SYSTEMATIC POSITION

The genus *Amsonia* is placed in the tribe Plumeroideae of the Apocynaceae because of its free unappendaged stamens.

The characters of an ovary containing six to many ovules, an eglandular calyx, coriaceous fruit, a hypercraterform corolla, and included stamens moreover place the genus in the subtribe Euplumeroideae.

The closest related genus to *Amsonia* appears to be for various reasons *Haplophyton*. The two genera are found in common territory from southern California to southwestern Texas. Morphologically the greatest dissimilarity lies in the seeds which are appendaged in *Haplophyton*. The leaves, which serve to aid the differentiation of the two genera in the 'Synoptical Flora,'[1] are not as widely separated as is ordinarily to be supposed, since they are not absolutely opposite in *Haplophyton* and alternate in *Amsonia*, but are more nearly approximate in the former and frequently subverticillate in the latter. The stamens are nearly alike in both genera, but are somewhat larger in *Haplophyton*. The character of the stigmatic head in that genus is also much like that of the stigmatic-head in the subgenus *Euamsonia* of *Amsonia*, although more elongate, but lacks a membranaceous reflexed appendage. However, a distinct swollen region occurs upon the stylar shaft of *Haplophyton* just below the papillose cap, which might be regarded as a primitive stage in the development of the more elaborate appendage of *Amsonia*. *Rhazya* is also a genus closely related to *Amsonia*, but possesses a disc and a jointed clavuncle among other dissimilarities.

Relationship and Distribution of the Subgenera

The genus *Amsonia*, although relatively a small group, is readily separable into three subgenera, which, while interlocking closely, are distinct and well differentiated entities in the whole. The series of subgenera range in geographical and evolutionary succession from east to west and south in North America, upon which continent the bulk of the species occur, only one species being found in eastern Asia.

The subgenus *Euamsonia* is the largest of the divisions in number of species and varieties and the most widely spread, embracing five species and four varieties in the southeastern United States, and one species in Japan. The second largest

[1] Gray, Syn. Fl. N. Am. 2[1]: 81. 1878.

subgenus with regard to number of species and extent of distribution is *Sphinctosiphon*, which occurs with eight species in the central-southwestern United States and adjacent Mexico, having for its center of distribution southern New Mexico and northern Chihuahua. *Articularia* is the smallest of the subgenera, and contains four species limited to southern California, southern Nevada, southwestern Utah, and western Arizona; while one species, *A. arenaria*, is isolated from the general distribution of the subgenus to which it belongs, in extreme southwestern New Mexico and adjoining Chihuahua.

The situation of *Euamsonia* in having species of the southeastern United States and Japan is by this time of more or less frequent knowledge, and no speculations will be devoted to it, since similar instances have been reported.[1, 2, etc.]. The occurrence of the three subgenera in the southern United States and northern Mexico is, however, of general interest.

A study of the genus in North America suggests forcibly that it is a genus of mesophytic origin which exhibits an increasing adaptation to an arid habitat. *Euamsonia* is the one subgenus of a mesophytic habit, and since it is represented by the relict species in Japan to which reference has already been made, it is taken as the most primitive. The subgenera *Sphinctosiphon* and *Articularia* are plants of distinctly arid habitat, and the morphological differentiation which those groups exhibit are interpreted as divergences from the primitive condition represented by *Euamsonia*.

The genus *Amsonia* is relatively advanced among the Plumeroideae because of its highly differentiated stigmatic-cap, among other characters, and it is upon the basis of further differentiation in that respect that the first subgeneric division is made. In the subgenus *Euamsonia* the stigma proper is depressed-capitate or truncate, and appears merely as the freer summit of the papillose central region of the stigmatic-cap to which reference was made in detail in the previous section concerning Gross Morphology. The mouth of the corolla-tube, moreover, is relatively open, continuing the dilation of the tube. In the

[1] Gray, A. Mem. Am. Acad. N. S. **6**: 377–449. 1859.
[2] Fernald, M. L. Quart. Rev. Biol. **1**: 227. 1926.

subgenus *Sphinctosiphon* an evolutionary advance is detected in the elevation of the stigma to the position of two distinct apiculate lobes, and the constriction of the mouth of the corolla-tube. Such differentiations are obviously of use to the plant for insect pollination in an arid region.

The subgenus *Articularia* demonstrates a further advance in the articulation of the follicles, which are quite slender and continuous in *Euamsonia* and *Sphinctosiphon*, into thickish constricted segments in much the same manner as the legumes of certain desert Leguminosae, beside having the apiculate characters of the stigma. The seeds of the follicles of *Articularia*, moreover, are larger and ovoid, and the endosperm is thickened, but of a light and corky texture, an evident construction to facilitate easy dissemination in an arid habitat. The seeds of *Euamsonia* and *Sphinctosiphon*, on the other hand, are roughly cylindrical with a relatively thin, hard endosperm.

The subgenera of *Amsonia* are remarkable for their interrupted distribution, a factor which lends even sharper distinction to the morphological differences which they display, and suggests certain hypotheses for their origin. *Euamsonia*, with the greatest number of species and varieties, has been found naturally in all of the southeastern United States, with a generally characteristic habitat of moist woods, ravines, or streamsides, save in its extreme western limits, where *A. ciliata* var. *texana* is found on rocky hillsides and prairies.

Sphinctosiphon, with the next largest number of species, is confined to southwestern Colorado, southeastern Utah, New Mexico, and adjacent portions of Arizona, Chihuahua, and Texas. Thus *Sphinctosiphon* and *Euamsonia* are entirely separate in range, except in south-central Texas, which contains two species of *Euamsonia* and a limited colony of *A. salpignantha* of *Sphinctosiphon*. Besides the anomalous occurrence of *A. salpignantha* within the southwestern limits of *Euamsonia* the nearest that the subgenera approach each other is evidently in western Texas, *Euamsonia* being found in the Wichita Mountains of north-central Texas, and *Sphinctosiphon* in the Guadaloupe Mountains about two hundred miles to the southwest. The species of *Sphinctosiphon*, although in an arid region,

partake of the nature of *Euamsonia* in frequenting the borders of ponds, streams, and branches.

Articularia, with the fewest number of species, is confined to southern California, southern Nevada, southwestern Utah, and northwestern Arizona, save for the species *A. arenaria*, which has a distribution analogous to the anomalous distribution of *A. salpignantha* of *Sphinctosiphon*, occurring separate from the other species with which it has its affinities, in extreme southwestern New Mexico (Grant County), and adjacent Chihuahua, within the distributional area of *Sphinctosiphon*. The species of *Articularia* demonstrate the most extreme endurance for aridity, being found most frequently in the sand of the open desert, whence, it is rather safely supposed, occurs the striking morphological adaptations which they exhibit.

Thus *Sphinctosiphon* and *Articularia* possess rather distinct areas of distribution, save for *A. arenaria* of *Articularia* which occurs fully three hundred miles, to present knowledge, from the known range of its kindred species, a perplexing situation. It is also possible that *A. Eastwoodiana* and *A. Jonesii*, species of *Articularia* and *Sphinctosiphon* respectively, meet in southern Utah and northern Arizona. At any rate, *A. Kearneyana*, occurring in regions midway between the territories of *Sphinctosiphon* and *Articularia*, for reasons which will be advanced later, appears in all probability an hybrid between *A. Palmeri* of the former subgenus and *A. brevifolia* of the latter. Thus it is seen that the subgenera of *Amsonia* occupy essentially distinct and isolated ranges, *Articularia* and *Sphinctosiphon*, the most nearly related of the groups morphologically and ecologically, being also the most neighborly distributed, and both distinctly removed from *Euamsonia*, the supposed primitive subgenus, morpho logically and geographically.

If we are to believe that by the Cretaceous the modern angiospermous type of vegetation had become fully established throughout the world,[1] we may assume that the genus *Amsonia* was by that time in a flourishing condition with a wide distribution over the southern half of what is now the United States

[1] Grabau, A. W. Textbook of geology **2**: 687. 1922.

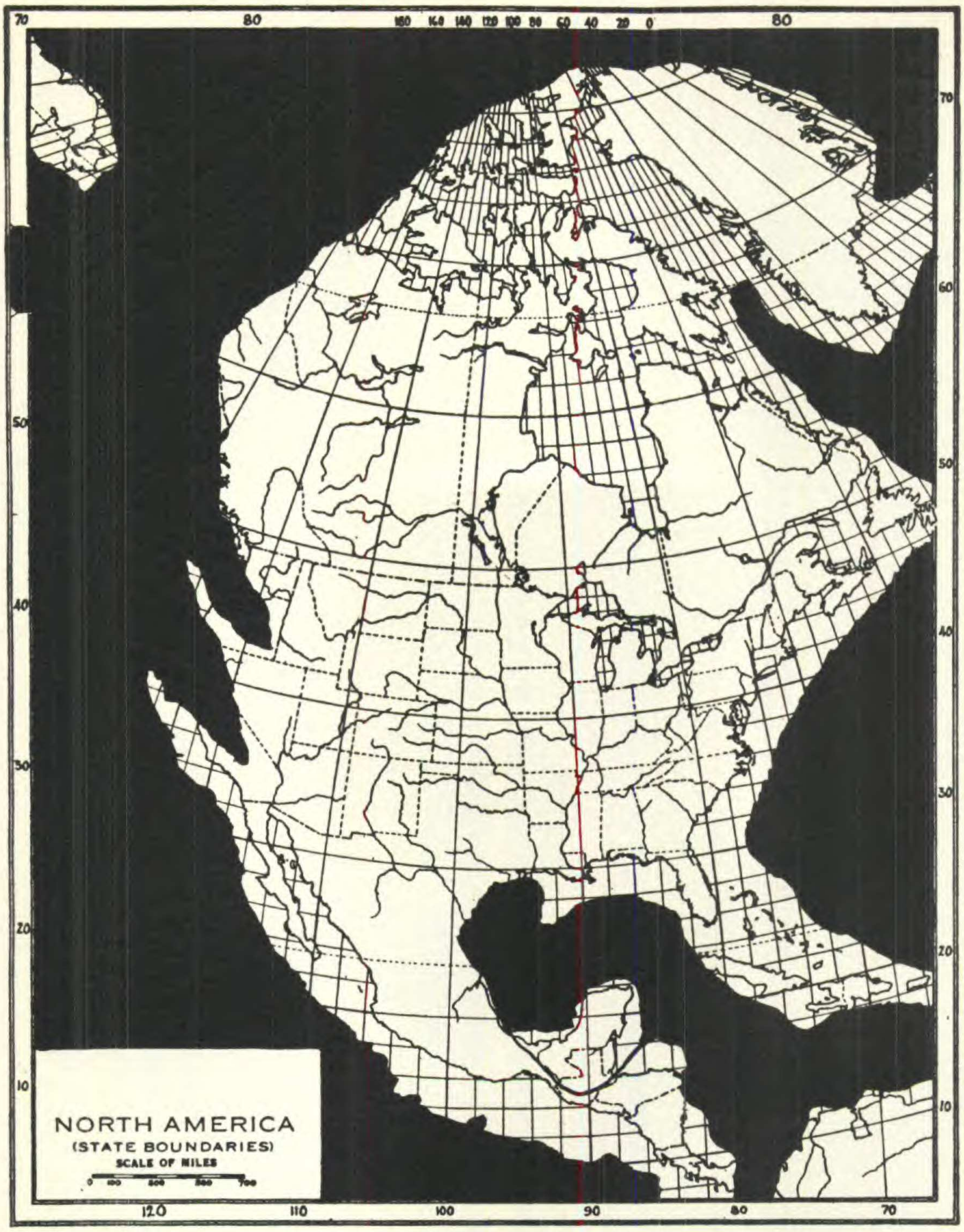


Fig. 1. Land mass of North America in Comanchean time.

and adjacent Mexico.[1] The position of the land masses in

[1] Stopes, M. C. Ancient plants, p. 85. 1910. Dr. Stopes wrote, in support of such an assumption: "Specimens of Cretaceous plants from various parts of the world seem to indicate that there was a striking uniformity in the flora of that period all over the globe."

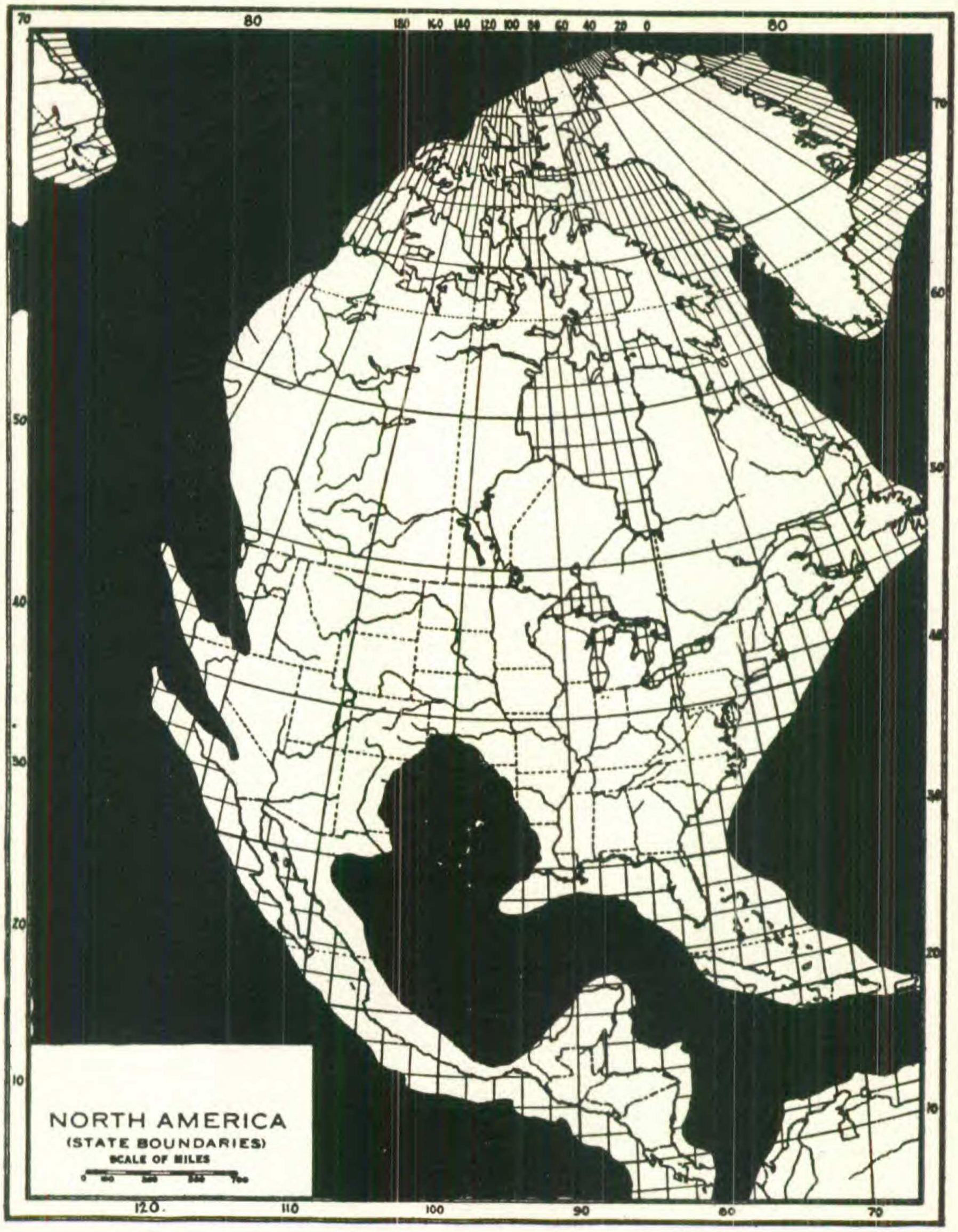


Fig. 2. Land mass of North America in late Comanchean time.

Comanchean, or lower Cretaceous, time would lend support to the speculation that the genus was allowed at that time practically an uninterrupted range (fig. 1), and because of that reason was very likely of a more or less uniform character. The

fact that the genus is now found as a relict in Japan is reason enough for assuming a wide range for its species.

During the late Comanchean time, however, the continuous range supposed for the genus was broken by the inundations of the Colorado Trough (fig. 2), which occurred over nearly the whole of northeastern Mexico, Texas, and parts of Oklahoma, Colorado, Kansas, and New Mexico. This invading sea could scarcely be regarded as less than a most effective opportunity for generic variation through isolation, especially since the vegetation in the isolated mass was by that time bearing evidence of an adaptation to aridity.[1]

The Cretaceous time, proper, is well known for the extensive inundations which then occurred widely in North America, and the break in the hypothetical distribution of *Amsonia* was heightened by an increase of the seas of the Colorado Trough, which cut completely through the continent from what is now the coast of the Territory of Mackenzie to the Gulf of Mexico. Troughs of the western coast also caused intrusions during the early periods of the Cenozoic, reaching a climax during Miocene time, when large tracts of southern California and adjacent Lower California and Arizona were separated as islands (fig. 3). By the Pliocene time, North America had largely assumed the shape with which we are now familiar.

With isolated land masses corresponding roughly to the localities of probable origin of the subgenera *Sphinctosiphon* and *Articularia*, a fair degree of credence might be allowed the assumption of their differentiation upon those lands, the first instance of isolation, the intrusion of the Colorado Trough, possibly giving rise to the development of the type of *Sphinctosiphon* from the primitive condition represented at present by *Euamsonia*, and the second, the production of islands by the inundations of the west coast troughs during the Miocene, providing an opportunity for the divergence of the type of *Articularia* from the group now represented by *Sphinctosiphon*. It is

[1] Schuchert, C. Outlines of historical geology. 1924. "In general we may say that after the early upper Cretaceous time . . . the climate the world over was . . . warm temperate in character [p. 612.] With the Miocene, however . . . more or less of desert climates developed in the Cordilleran areas of North America and have prevailed there ever since [p. 626]."

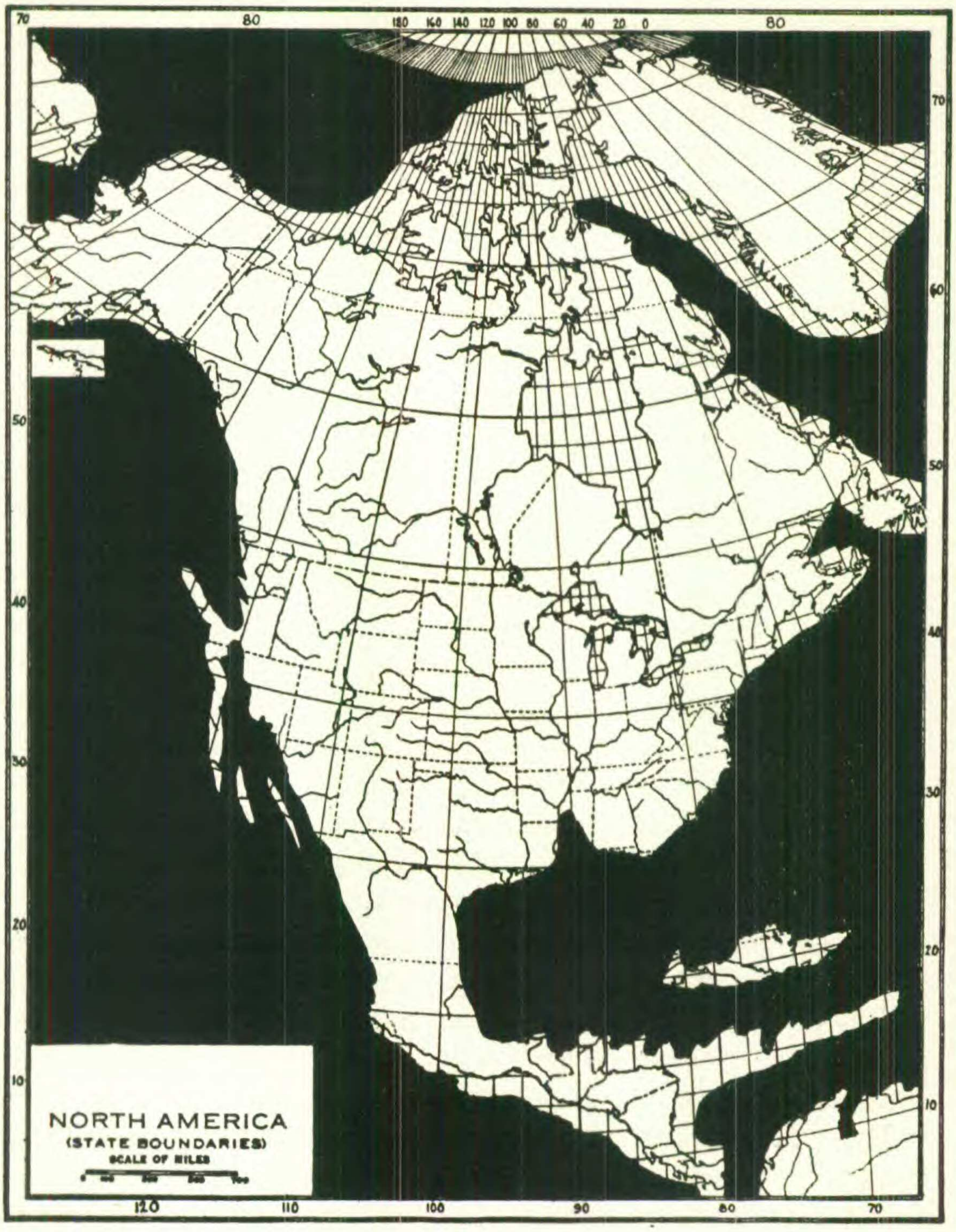


Fig. 3. Land mass of North America in upper Cretaceous time.

believed that the discontinuous areas of the subgenera support the hypothesis offered for their origin. The fact that the distribution of the three subgenera still bears evidence of disruption thousands of years after the Mesozoic and Cenozoic inundations appears quite striking, and bears additional evidence of

the old age[1] of the genus in its inability to reunite its former distribution. In this respect, the genus *Amsonia* offers an interesting parallel to the endemics of the unglaciated regions of boreal America, whose ranges were broken by the Pleistocene glacial phenomena: "These older species in North America have long since passed their period of aggressiveness. 'Left undisturbed they persist in their old habitats, but they fail to move into new and immediately neighboring territory.'"[2]

Abbreviations

Abbreviations indicating the herbaria where specimens cited in this monograph are deposited are as follows:

Baker = C. F. Baker Herbarium of Pomona College.
F = Field Museum of Natural History Herbarium.
G = Gray Herbarium of Harvard University.
MBG = Missouri Botanical Garden Herbarium.
NE = New England Botanical Club Herbarium.
NY = New York Botanical Garden Herbarium.
P = Pomona College Herbarium.
ANSP = Academy of Natural Sciences of Philadelphia Herbarium.
PBC = Philadelphia Botanical Club Herbarium.

TAXONOMY

Amsonia Walt. Fl. Carol. 98. 1788; Michx. Fl. Bor. Am. **1:** 121. 1803; Pursh, Fl. Am. Sept. ed. 1, **1:** 184. 1814; Roem. & Schult. Syst. Veg. **4:** 432. 1819; Smith in Rees, Cycl. **35:** end of art. "Tabernaemontana." 1819; Elliott, Sketch Bot. S. C. & Ga. 316. 1821; Endl. Gen. Pl. 582. 1838; A. DC. in DC. Prodr. **8:** 384. 1844; Pfeiffer, Nom. Bot. **1**[1]**:** 156. 1873; Benth. & Hook. Gen. Pl. **2:** 703. 1876; Gray, Syn. Fl. N. Am. **2**[1]**:** 81. 1878; Durand, Index Gen. Phan. 262. 1888; Baill. Hist. Pl. **10:** 180. 1891; Coulter, Contr. U. S. Nat. Herb. **2:** 262. 1892; Coville, Contr. U. S. Nat. Herb. **4:** 142. 1893;

[1] The presence of *Amsonia* in the Cretaceous period would give to the genus an age, based upon the most capable of present calculations (Schuchert, C. *l. c.* 485. 1924), of at least 45,000,000 years.

[2] Fernald, M. L. Persistence of plants in unglaciated areas of boreal America. Mem. Am. Acad. **15:** 244. 1925; Antiquity of vascular plants. Quart. Rev. Biol. **1:** 227. 1926.

K. Schumann in Engl. & Prantl, Nat. Pflanzenfam. **4²**: 143. 1895; Mohr, Contr. U. S. Nat. Herb. **6**: 674. 1901; Small, Fl. Southeast. U. S. 934. 1903; Dalla Torre & Harms, Gen. Siph. 406. 1904; Harper, Ann. N. Y. Acad. Sci. **17¹**: 175. 1906; Robinson & Fernald in Gray, New Man. ed. 7, 661. 1908; Nelson in Coulter & Nelson, New Man. Rocky Mt. Bot. 385. 1909; Matsumura, Index Pl. Jap. **2**: 505. 1912; Wooton & Standley, Contr. U. S. Nat. Herb. **19**: 504. 1915; Rydb. Fl. Rocky Mts. 668. 1917; Davidson & Moxley, Fl. South. Cal. 278. 1923; Tidestrom, Contr. U. S. Nat. Herb. **25**: 418. 1925; Jepson, Man. Fl. Pl. Cal. 768. 1925.

Ansonia Raf. New Fl. N. Am. **4**: 58. 1838.

Lactescent herbaceous caulescent perennials, glabrous or pubescent. Leaves alternate or subverticillate, sessile or petiolate, membranaceous or somewhat thickened and fleshy, entire. Inflorescence a terminal thyrsoid or corymbose cyme. Calyx five-parted, the lobes acuminate or subulate. Corolla salverform, villous within, tube cylindrical, dilating, open or constricted; lobes ovate to lanceolate, spreading or nearly erect. Stamens five, adnate to the corolla-tube above the middle, included; anthers ovate to ovate-lanceolate, obtuse, unappendaged. Disk wanting. Carpels two, united by the filiform style surmounted by a truncate stigmatic-cap. Stigma depressed-capitate, or apiculate by two distinct lobes, surrounded by a spherical papillose mass, and appendaged by a reflexed membrane. Ovules in each carpel many, two-seriate. Follicles two, cylindrical, continuous or articulated. Seeds many, one-seriate, cylindrical, unappendaged. Embryo straight.

Type species: *A. Tabernaemontana* Walt. Fl. Carol. 98. 1788.

SYNOPSIS OF THE SUBGENERA AND SECTIONS

KEY TO THE SUBGENERA

A. Stigma depressed-capitate or truncate.....Subgenus I. EUAMSONIA

B. Stigma apiculate by two distinct lobes.

a. Follicles continuous, not articulated.....Subgenus II. SPHINCTOSIPHON

b. Follicles torose, articulated into thickish constricted segments.....Subgenus III. ARTICULARIA

SUBGENUS I. EUAMSONIA (K. Schumann) Woodson

Subgenus I. EUAMSONIA (K. Schumann) Woodson, n. comb.

§*Euamsonia* K. Schumann in Engl. & Prantl, Nat. Pflanzen-

fam. 4²: 143. 1895; Dalla Torre & Harms, Gen. Siph. 406. 1904.

Bracteoles inconspicuous; orifice of the corolla-tube not constricted in anthesis; stigma depressed-capitate or truncate; follicles slender and continuous, not articulate, fibrous, not horny in texture; seeds irregularly oblong in outline, truncate at either end, variously pitted and wrinkled; plants of the southeastern United States and Japan. Spp. 1–5.

KEY TO THE SPECIES AND VARIETIES

a. Corolla glabrous without.
  b. Leaf-blades elliptic, distinctly petiolate throughout.....*1. A. rigida*
  bb. Leaf-blades oblong-lanceolate to linear, sessile or subsessile above.
    c. Corolla-tube 6–8 mm. long.
      d. Stem-leaves 4–15 times as long as broad; inflorescence barely held above the foliage.....*2. A. ciliata*
      dd. Stem-leaves 15–30 times as long as broad; inflorescence held high above the foliage.....*2a. A. ciliata* var. *tenuifolium*
    cc. Corolla-tube 9–12 mm. long.
      d. Corolla-lobes about half as long as the tube; pedicels 3–5 mm. long; species of North America..*2b. A. ciliata* var. *texana*
      dd. Corolla-lobes about equalling the tube; pedicels 5–10 mm. long; species of Asia.....*3. A. elliptica*
aa. Corolla pubescent without.
  b. Follicles glabrous.
    c. Leaf-blades ovate to oblong-lanceolate, the bases of the lower obtuse to broadly acute.....*4. A. Tabernaemontana*
    cc. Leaf-blades lanceolate to linear-lanceolate, the bases of the lower acute to acuminate.
      d. Inflorescence loose, few-flowered; foliage glabrous, glaucous beneath.....*4a. A. Tabernaemontana* var. *salicifolia*
      dd. Inflorescence dense, many-flowered; foliage pubescent, glabrate in age.....*4b. A. Tabernaemontana* var. *Gattingeri*
  bb. Follicles pubescent, at least upon the upper portion.....*5. A. ludoviciana*

1. Amsonia rigida Shuttlew. in Small, Fl. Southeast. U. S. 935. 1903; Harper, Ann. N. Y. Acad. Sci. **17**¹: 175. 1906. Pl. 51, figs. 4–6.

Herbaceous perennial from a thickened somewhat woody root; stems 8–15 dm. tall, regularly branched above, glabrous; leaves alternate, numerous, the blades almost exactly elliptic, isophyllous, *i. e.*, the lower and the upper leaves of nearly like outline, green above, glaucous or glaucescent beneath, 2.5–6 cm. long, .5–1.5 cm. broad, distinctly petiolate throughout; flowers rela-

tively numerous in fairly loose cymes; pedicels 5 mm. long or slightly less; calyx 1–1.5 mm. long, glabrous, the lobes triangular-ovate; corolla salverform, the tube 6–8 mm. long, gradually dilating upwards, glabrous without, the lobes lanceolate, 7–10 mm. long, widely spreading; stigmatic-cap about as tall as broad, stigma depressed-capitate; follicles slender, continuous, gradually attenuate, 7–11 cm. long, sessile, glabrous, 7–10-seeded; seeds 5–11 mm. long, oblong in outline, truncate at either end, variously wrinkled and pitted, dark brown.

Distribution: swampy or moist pine forests, northern Florida and southern Georgia.

Specimens examined:

Georgia: Alapaha, swampy pine woods, June 25, 1901, *Curtiss 6820* (G, MBG, NY, US); Sumter Co., moist pine barrens, Aug. 21, 1900, *Harper 448* (G, MBG, NY, US, F); same locality, Sept. 6, 1900, *Harper 606* (NY, US); same locality, Aug. 21, 1900, *Harper 440* (NY, US).

Florida: Chattahoochee, May, 1882, *Curtiss* (G); data lacking, *Chapman* (G, ANSP, MBG); St. Marks, June, 1843, *Rugel* (MBG); Chattahoochee, 1891, *Chapman* (MBG).

2. Amsonia ciliata Walt. Fl. Carol. 98. 1788; A. DC. in DC. Prodr. **8**: 385. 1844; Wood, Classbook Bot. 589. 1860; Chapm. Fl. South. U. S. 343. 1897; Mohr, Contr. U. S. Nat. Herb. **6**: 674. 1901; Small, Fl. Southeast. U. S. 935. 1903; Harper, Ann. N. Y. Acad. Sci. **17**[1]: 175. 1906. Pl. 51, figs. 7–8.

Tabernaemontana angustifolia Ait. Hort. Kew. **1**: 300. 1789; Willd. Sp. Pl. **1**[2]: 1247. 1798.

Amsonia angustifolia (Ait.) Michx. Fl. Bor. Am. **1**: 121. 1803; Pursh, Fl. Am. Sept. ed. 1, **1**: 184. 1814; Roem. & Schult. Syst. Veg. **4**: 432. 1819; Ell. Sketch Bot. S. C. & Ga. 317. 1821; Darby, Bot. South. States, 434. 1860; Gray, Syn. Fl. N. Am. **2**[1]: 81. 1878.

Ansonia ciliata (Walt.) Raf. New Fl. N. Am. **4**: 58. 1838.

Ansonia angustifolia (Ait.) Raf. *l. c.* 1838.

Herbaceous perennial from a thickened woody root; stems 7–15 dm. tall, clustered from the base, erect or slightly ascending, sparsely branched above, the branches ascending, pubes-

cent, glabrous or glabrate in age; leaves numerous, crowded, subverticillate above, slightly heterophyllous, *i. e.*, the lower leaves broader and of a slightly different outline than the upper, linear-lanceolate, or the lower oblong-lanceolate, pubescent, or glabrate in age; inflorescence dense, barely held above the foliage; pedicels 3–5 mm. long, sparsely pubescent; calyx 1–1.5 mm. long, glabrous, or with a few scattered hairs, the lobes triangular-ovate; corolla salverform, the tube 6–8 mm. long, glabrous without, the lobes 7–8 mm. long, oblong-lanceolate, erect or spreading; stigmatic-cap slightly broader than tall, stigma depressed-capitate or truncate; follicles slender, continuous, 9–11 cm. long, gradually attenuate, sessile, glabrous, 7–11-seeded; seeds 5–11 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, dark brown.

Distribution: pine forests, occasionally entering fields; North Carolina, South Carolina, southern Georgia, northern Florida, southern Alabama, and northeastern Texas.

Specimens examined:

North Carolina: data lacking, *Curtis* (G).

South Carolina: Aiken, April, 1882, *Velden* (MBG); Aiken, sand hills near Graniteville, May 7, 1899, *Eggert* (MBG); Aiken, May, 1869, *Canby 68* (MBG, G, NY); Columbia, woods, May 9, 1899, *Sargent* (G); data lacking, *Ravenel* (G, NY, US); Columbia, dry sandy pine woods, May, 1890, *Taylor* (F).

Georgia: Richmond Co., slopes of sand hills about 8 miles west of Augusta, June 10, 1902, *Harper 1319* (US, NY, F); Augusta, date lacking, *Olney & Metcalfe 76* (G); data lacking, *Wilkins* (G).

Florida: Tallahassee, date lacking, *Berg* (NY); Aspalaga, dry pine woods, April, year lacking, *Curtiss 2269* (G, MBG, ANSP, US, F); River Junction, fields and open woods, April 22 and May 16, 1898, *Curtiss 6376* (G, NY, US, MBG); data lacking, *Chapman* (G); Aspalaga, May, 1898, *Chapman* (MBG); Coffee Co., rocky open ground, flood plains of Pea River, May 15, 1925, *E. J. Palmer 27233* (MBG); Chehaw, June 24, 1915, *Drushel 4572* (MBG).

Alabama: data lacking, *Durand* (ANSP).

Texas: San Marcos, June 6, 1897, *Stanfield* (NY); Mid-

lothian, April 30, 1895, *Plank* (NY); Turtle Creek, Kerr Co., date lacking, *Bray 239* (US); Orange, April 17, 1899, *Bray 60* (US).

Although recognizing that *A. ciliata* Walt. antedates *A. angustifolia* (Ait.) Michx., Gray placed Walter's species in synonymy with the latter species, remarking that *ciliata* was an inappropriate name. The specimens with Gray's labels in the Gray Herbarium truly are glabrate or glabrous, being overly matured specimens, hence Dr. Gray's impression. In any event, Walter's name can scarcely be discarded.

2a. Var. **tenuifolia** (Raf.) Woodson, n. comb.

Ansonia tenuifolia Raf. New Fl. N. Am. **4:** 58. 1838.

Amsonia salicifolia Pursh var. *ciliolata* A. DC. in DC. Prodr. **8:** 384. 1844.

Amsonia ciliata Walt. var. *filifolia* Wood, Classbook Bot. 589. 1860.

Amsonia tenuifolia (Raf.) Harper, Ann. N. Y. Acad. Sci. **17**[1]**:** 175. 1906.

Herbaceous perennial from a fibrous root; stems 3–10 dm. tall, single or sparingly clustered from the base, erect or slightly ascending, sparingly branched above, the branches ascending, pubescent or glabrate in age; leaves numerous, crowded, subverticillate, scarcely heterophyllous, *i. e.*, the lower leaves barely broader and of about the same outline as the upper, linear-lanceolate to filiform, pubescent or glabrate; inflorescence dense, held high above the foliage by a slender, usually leafless stalk; pedicels 3–5 mm. long, barely strigose or glabrous; calyx 1–2 mm. long, glabrous, or with a few short hairs, the lobes triangular-attenuate; corolla salverform, the tube 6–8 mm. long, glabrous or slightly canescent without, the lobes 4–6 mm. long, ovate to oblong-lanceolate, erect or spreading; stigmatic-cap about as tall as broad, stigma depressed-capitate or truncate; follicles slender, continuous, 8–14 cm. long; seeds 7–12 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, brown.

Distribution: sand-hills and barrens, also rocky margins of streams; North Carolina, South Carolina, Georgia, Florida, Ala-

bama, southern Arkansas, Missouri, Texas, and central Mexico.

Specimens examined:

UNITED STATES:

NORTH CAROLINA: data lacking, *Curtis* (G); White Hall, May 13, 1896, *Biltmore 1400* (US).

SOUTH CAROLINA: Aiken, May 21, 1899, *Eggert* (MBG).

GEORGIA: Altamaha, sand-hills, date lacking, *Chapman* (G); Augusta, sand-hills, June 10, 1902, *Harper 1319* (G, MBG, NY); Bainbridge, low woods bordering Flint River, July 13, 1899, *Curtiss 6476* (G, MBG, NY, US); Bulloch Co., sand-hills along Big Lott's Creek, June 17, 1901, *Harper 915* (G, MBG, NY, US, F); Camilla, Mitchell Co., dry sand barrens, Aug. 7, *Harper 1166* (G, NY, US); Dublin, Laurens Co., sand-hills of Oconee River, April 20, 1904, *Harper 2138* (G, MBG, NY, US, F); Jasper City, 1846–48, *Porter* (G); Dooly Co., dry pine barrens near Gum Creek, Sept. 3, 1900, *Harper 577* (US); Burke Co., Aug. 15, 1897, *Hopkins 83* (NY); Thomson, McDuffie Co., sand-hills, Sept. 9, year lacking *Bartlett 1493* (P); Vidalia, April, 1914, *Huger* (MBG); Macon, date lacking, *Green* (ANSP).

FLORIDA: Bellair, Sept. 3, 1895, *Nash 2546* (G, MBG, US, F); Clarcona, Orange Co., date lacking, *Meislahn 210* (US); Gotha, March 28, 1919, *Nehrling 12* (US); pine woods west of Jacksonville, April, 1848, *Rugel 21* (US, MBG, F, NY); data lacking, 1873, *Fell* (ANSP); Cocoanut Grove, 1899, *Rodman* (G); Sumter Co., grassy pine-barrens, March 11, 1883, *Donnell-Smith* (G); "East Florida," date lacking, *Buckley* (G); "Middle Florida," date lacking, *Eaton* (G); data lacking, *Buckley* (G); Alachua Co., June–July, 1898, *Hitchcock* (MBG); Lake Brantley, Aug. 1, 1895, *Williamson* (ANSP).

ALABAMA: data lacking, *Buckley* (MBG); Bon Secour (near Mobile), June 29, 1893, *Mohr* (US).

MISSOURI: Ozark Co., rocky open ground, bald knobs, near Tecumseh, Oct. 9, 1927, *E. J. Palmer 33031* (MBG); summit of bald knob across river from Tecumseh, Ozark Co., Nov. 11, 1928, *Anderson & Woodson 4000* (MBG).

ARKANSAS: Logan Co., rocky margins of small streams, Oct. 18, 1923, *E. J. Palmer 24203* (G); Hot Springs, Aug. 5, 1879, *Letterman* (MBG); Arkadelphia, May 10, 1884, *Letterman* (MBG).

Texas: data lacking, *Wright* (G); Medina Lake, Bandera Co., limestone ledges, creek banks, June 14, 1917, *E. J. Palmer 12262* (MBG); Johnson Co., rocky prairies, April, 1882, *Reverchon 84* (MBG).

Mexico:

Michoacan: Morelia, June, 1901, *Arséne* (F).

2b. Var. **texana** (Gray) Coulter, Contr. U. S. Nat. Herb. **2**: 262. 1892.

Amsonia angustifolia Michx. var. *Texana* Gray, Syn. Fl. N. Am. **2**[1]: 81. 1878.

Amsonia texana (Gray) Heller, Muhlenbergia **1**: 2. 1900; Small, Fl. Southeast. U. S. 935. 1903; Rydb. Fl. Colo. 269. 1906; Nelson in Coulter & Nelson, New Man. Rocky Mt. Bot. 385. 1909; Clem. & Clem. Rocky Mt. Fl. 100. 1914.

Herbaceous perennial from a slightly woody root; stems 2–5 dm. tall, usually clustered from the base, erect or slightly ascending or spreading, occasionally pubescent when young, mostly glabrous; leaves alternate, numerous, quite heterophyllous, *i. e.*, the lower leaves broader and of a different outline than the upper, ovate to oblong-lanceolate below, lanceolate to linear-lanceolate above, occasionally with short scattered hairs; inflorescence compact, barely held above the foliage; pedicels 3–5 mm. long; calyx 1.5–2.5 mm. long, glabrous or glabrate, the lobes triangular-lanceolate to subulate; corolla salverform, the tube 9–11 mm. long, glabrous without, the lobes 4–6 mm. long, ovate to ovate-lanceolate, spreading; stigmatic-cap broader than tall, stigma truncate; follicles slender, continuous, 6–10 cm. long, rather abruptly acuminate, sessile, glabrous 5–15-seeded; seeds 5–11 mm. long, oblong in outline, truncate at the ends, variously pitted or wrinkled, brown.

Distribution: dry and rocky hillsides and prairies; Oklahoma, and Texas.

Specimens examined:

Oklahoma: Crusher Spur, Murray Co., rocky mountain-side, April 12, 1913, *Stevens 29* (G, MBG, US); Fort Sill, May 20, 1892, *Sydone* (NY); Tishomingo, on hillsides, common, April 8, 1916, *Houghton 3606* (G); vicinity of Fort Sill, April 12, 1916,

Clemens 11727 (MBG); Cache, Comanche Co., dry hillsides, decomposed granite, July 19, 1917, *E. J. Palmer 12597* (MBG); Davis, Arbuckle Mts., April 1, 1916, *Emig 399* (MBG).

TEXAS: Comanche Springs, March, 1849, *Lindheimer* (G, MBG); Dallas, rocky prairies, April, 1875, *Reverchon* (G, NY, MBG); Dallas, dry uplands, March–June, year lacking, *Reverchon* (G, MBG); "Upper Colorado," rocky places, 1847, *Lindheimer 660* (G TYPE, MBG, US, F); Fort Worth, rocky hillsides, May 7, 1911, *Ruth 241* (G, NY, ANSP, F); "Witicha Mtns.," July, 1852, *Torrey* (G, NY); data lacking, *Lindheimer* (ANSP, MBG); Dallas, dry soil, April–June, 1877, *Reverchon 598* (US, MBG); Dallas, common in woods, May 7, 1900, *Bush 646* (US, NY, MBG); Dallas, rocky prairies, June 30, 1877, *Hall 515* (US, MBG, NY); Forks, May 27, year lacking, *Reverchon* (MBG); Boerne, Kendall Co., low rocky creek banks, April 6, 1917, *E. J. Palmer 11471* (MBG); Dallas, rocky hills, West Dallas, June 22, 1899, *Eggert* (MBG); Hood Co., prairies, May 4, 1900, *Eggert* (MBG); Dallas, cement works, April 12, 1902, *Reverchon* (MBG); data lacking, *Lindheimer 4* (MBG); Gillespie Co., date lacking, *Jermy 145* (MBG); Dallas, open limestone hills, May 4, 1918, *E. J. Palmer 13496* (MBG); Lacey's Ranch, Kerr Co., moist rocky creek banks, June 11, 1917, *E. J. Palmer 12233* (MBG); Bull Creek, near Austin, April 11, 1914, *Young* (MBG); Boerne, Kendall Co., moist rocky creek banks, April 20, 1917, *E. J. Palmer 11616* (MBG); Dallas, high prairies, April 12, 1902, *Reverchon 3122* (MBG).

3. Amsonia elliptica (Thunb.) Roem. & Schult. Syst. Veg. **4:** 432. 1819; A. DC. in DC. Prodr. **8:** 384. 1844; Franch. & Savatier, Enum. Pl. Jap. **1:** 315. 1874; K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. **4²:** 143. 1895; Matsumura, Index Pl. Jap. **2:** 505. 1912. Pl. 51, figs. 9–10.

Tabernaemontana elliptica Thunb. Fl. Jap. 111. 1784.

Ansonia elliptica (Thunb.) Raf. New Fl. N. Am. **4:** 58. 1838.

"*Amsonia elliptica* Sieb. & Zucc." in Gray, Mem. Am. Acad. **6:** 403. 1857.

Herbaceous perennial from a slightly thickened root; stems 4–7 dm. tall, single or clustered from the base, erect or slightly

ascending, glabrous, or very slightly pubescent when young, branched above, the branches ascending or somewhat spreading; leaves alternate, relatively distant, the blades relatively narrow, lanceolate to linear-lanceolate, the lower 5–10 times as long as broad, both the bases and the apices narrowly acute to acuminate, glabrous above, glaucescent beneath, becoming green in age; inflorescence loose, relatively few-flowered, pedicels 5–10 mm. long; calyx 1–2 mm. long, the lobes triangular-lanceolate, glabrous; corolla salverform, the tube relatively broad, 10–12 mm. long, glabrous without; the lobes of about equal length, oblong-lanceolate, spreading; stigmatic-cap about as broad as tall, stigma depressed-capitate or truncate; follicles relatively stout, continuous, or very slightly torose, 4–6 cm. long, sessile, glabrous, 5–10-seeded; seeds 5–10 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, brown.

Distribution: northern Japanese Archipelago.

Specimens examined:

JAPAN: Hakodate, 1861, *Maximowicz* (G); Jesso, near Hakodate, 1861, *Albrecht* (G); Todahara, Musashi, May 24, 1891, *Watanabe* (G); Tokio, May 7, 1879, *Matsumura* (US); Musaski, Toda, May 27, 1911, collector lacking (US).

4. Amsonia Tabernaemontana Walt. Fl. Carol. 98. 1788; Pers. Syn. **1**: 269. 1801; A. DC. in DC. Prodr. **8**: 384. 1844; Rept. Torr. Bot. Mex. Bound. Surv. 159. 1859; Gray, Syn. Fl. N. Am. **2**^{1}: 81. 1878; Wood, Classbook Bot. 589. 1860; Gattinger, Tenn. Fl. 63. 1887; Coulter, Contr. U. S. Nat. Herb. **2**: 262. 1892; K. Schumann in Engl. & Prantl, Nat. Pflanzenfam. **4**^{2}: 143. 1895; Chapm. Fl. South. U. S. 343. 1897; Robinson & Fernald in Gray, New Man. ed. 7, 661. 1908.

Pl. 51, figs. 11–13.

Anonymus suffrutex Gronov. Fl. Virg. ed. 2, 35. 1762.

Tabernaemontana Amsonia L. Sp. Pl. ed. 2, **2**: 301. 1762; Willd. Sp. Pl. **1**^{2}: 1246. 1798.

Tabernaemontana humilis Salisb. Prodr. 148. 1796.

Amsonia latifolia Michx. Fl. Bor. Am. **1**: 121. 1803; Pursh, Fl. Am. Sept. ed. 1, **1**: 184. 1814; Roem. & Schult. Syst. Veg. **4**:

432. 1819; Elliott, Sketch Bot. S. C. & Ga. 316. 1821; Darby, Bot. South. States, 434. 1860.

Amsonia tristis Sm. in Rees, Cycl. **35**: end of art. "Tabernaemontana." 1819; A. DC. in DC. Prodr. **8**: 384. 1844.

Ansonia latifolia (Michx.) Raf. New Fl. N. Am. **4**: 58. 1838.

Amsonia Amsonia (L.) Britton, Mem. Torr. Bot. Club **5**: 262. 1894; Britton & Brown, Ill. Fl. **3**: 1. 1898; S. Coulter, Rept. Dept. Geol. Ind. **24**: 880. 1899; Hitchcock, Fl. Kans. 13. 1899; Gattinger, Fl. Tenn. 137. 1901; Mohr, Contr. U. S. Nat. Herb. **6**: 674. 1901; Small, Fl. Southeast. U. S. 935. 1903; Lowe, Miss. State Geol. Surv. Bull. 17: 227. 1921.

Herbaceous perennial from a thickened, slightly woody root; stems 3–10 dm. tall, usually clustered from the base, erect or slightly ascending, branched above, the branches ascending or spreading, occasionally somewhat pubescent when young; leaves alternate, relatively distant, ovate to oblong-elliptic, the bases of the lower obtuse to broadly acute, occasionally sparsely pubescent upon the lower surface when very young; inflorescence relatively small and dense, barely held above the foliage, pedicels 3–5 mm. long; calyx 1–1.5 mm. long, glabrous, the lobes triangular-ovate; corolla salverform, the tube 6–8 mm. long, pubescent without, the lobes 4–6 mm. long, oblong to oblong-lanceolate, spreading; stigmatic-cap about as tall as broad, stigma depressed-capitate; follicles continuous, 8–10 cm. long, rather abruptly acuminate, sessile, glabrous, 5–15-seeded; seeds 5–11 mm. long, oblong in outline, truncate at either end, variously pitted and wrinkled, dark brown.

Distribution: moist woods and waste-lands, river-banks, etc.; South Carolina, Tennessee, Illinois, eastern Missouri, eastern Oklahoma, eastern Kansas, southeastern Arkansas, escaped from cultivation in Massachusetts, New Jersey, Pennsylvania, and Delaware.

Specimens examined:

MASSACHUSETTS: Boston, Back Bay waste-lands, Aug. 12, 1903, *Williams* (G); Hampden, June, 1911, *Knowlton* (NE).

NEW JERSEY: South New England Road, introduced in field, Cold Spring, Cape May Co., July 7, 1918, *Brown* (PBC).

DELAWARE: Wilmington, waste places, June 3–July 18, 1896, *Commons* (PBC).

PENNSYLVANIA: Oakdale, near Philadelphia, June, 1863, *Martindale* (PBC); Philadelphia, Broad Street & Germantown R. R., 1865, *Martindale 4864* (MBG); Gradyville, Delaware Co., June 9, 1898, *Painter* (PBC); near Philadelphia, May, 1889, *Leeds* (PBC); Gradyville, June 3, 1904, *Vail 546* (US).

SOUTH CAROLINA: Greenville Co., ravines near Caesar's Head, Aug. 5, 1881, *J. D. Smith* (G).

TENNESSEE: Knoxville, thicket on Tennessee River bank, April and July, 1890, *Ruth 174* (G); Knoxville, April, 1894, *Ruth 466* (P, US); Knoxville, June, 1898, *Ruth 480* (MBG).

ILLINOIS: Chandlersville, Aug. 19, 1886, *Seymour 1584* (G, P).

MISSOURI: St. Louis, July 2, 1895, *Glatfelter* (G, MBG); St. Louis, date lacking, *Engelmann* (G, MBG); Eagle Rock, uncommon in barrens, June 22, *Bush 11* (MBG, US); uncommon in rich woods, 4 miles e. of Carthage, May 27, 1906, *E. J. Palmer 921* (MBG); Newton Co., cherty barrens, July 15, 1906, *E. J. Palmer 12* (MBG); Carthage, rich woods, May 27, 1906, *E. J. Palmer 818* (MBG); Noel, low ground, May 10, 1915, *Bush 7513* (MBG); Noel, McDonald Co., thickets, hillsides, Sept. 12, 1913, *E. J. Palmer 4305* (MBG); Swan, common in woods, Oct. 4, 1899, *Bush 753* (MBG).

ARKANSAS: Fort Huron, date lacking, *Edward* (G); Fayetteville, May, year lacking, *Harvey 38* (ANSP); Fulton, low ground, April 17, 1905, *Bush 2378* (MBG); Fayetteville, May 10, 1919, *Wells* (US).

LOUISIANA: Hammond, April 10, 1889, *Gallup 4* (US).

OKLAHOMA: Leflore Co., Page, on bank of mountain creek near Rich Mountain, Sept. 8, 1913, *Stevens 2670* (G, US); Page, Leflore Co., on rocky mountain-side, April 25, 1915, *Blakely 3425* (G); Poteau, Leflore Co., July 13, 1915, *E. J. Palmer 8286* (MBG).

KANSAS: Cherokee Co., rocky woods, May 7, 1897, *Hitchcock 76a* (MBG).

4a. Var. **salicifolia** (Pursh) Woodson, n. comb.

Amsonia salicifolia Pursh, Fl. Am. Sept. ed. 1, 1: 184. 1814;

Roem. & Schult. Syst. Veg. 4: 432. 1819; Elliott, Sketch Bot. S. C. & Ga. 316. 1821; A. DC. in DC. Prodr. 8: 384. 1844; Darby, Bot. South. States, 434. 1860; Wood, Classbook Bot. 589. 1860; Small, Fl. Southeast. U. S. 935. 1903; Britton, Man. Fl. 737. 1907.

Ansonia salicifolia (Pursh) Raf. New Fl. N. Am. 4: 58. 1838.

Herbaceous perennial from a slightly thickened root; stems 3–5 dm. tall, usually clustered from the base, erect or slightly ascending, glabrous or very slightly pubescent when young, branched above, the branches ascending or somewhat spreading; leaves alternate, the blades relatively narrow, lanceolate to linear-lanceolate, the lower 5–10 times as long as broad, both the base and the apex narrowly acute to acuminate, glabrous above, glaucous or glaucescent beneath, becoming green in age; inflorescence loose, relatively few-flowered, pedicels 3–7 mm. long; calyx about 1 mm. long, the lobes minutely triangular, glabrous; corolla salverform, the tube relatively narrow, 6–10 mm. long, scatteringly pubescent without, the lobes 5–7 mm. long, lanceolate, spreading; stigmatic-cap somewhat broader than tall, stigma depressed-capitate or truncate; follicles relatively slender, continuous or very slightly torose, 8–10-seeded; seeds 5–10 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, brown.

Distribution: river-banks and moist thickets generally; Virginia, North Carolina, South Carolina, Georgia, Alabama, Louisiana, Kentucky, Tennessee, Indiana, Illinois, Missouri, Arkansas, and Texas.

Specimens examined:

VIRGINIA: Petersburg, date lacking, *Tuomey* (ANSP).

NORTH CAROLINA: Biltmore, river-banks, May 11, 1897, *Biltmore 81b* (G, MBG, US, NY); same locality, May 2, 1896, *Biltmore 81* (MBG); Weldon, April, 1897, *Williamson* (ANSP); same locality, April 19, 1908, *Williamson* (ANSP); Hot Springs, May 5, 1884, *Smith* (ANSP); Warm Springs, May 6, 1887, *Smith* (ANSP); Columbus, 1897, *Townsend* (US); Statesville, May, 1878, *Hyams* (US); Granville Co., May, 1873, *Faxon* (G); Mt. Tryon, Polk Co., moist rich soil on a level spot along a mountain rill, May, 1918, *Millspaugh 4030* (F); Weldon, April 19, 1908, *Bartram* (G); data lacking, *Curtis* (G).

SOUTH CAROLINA: Oconee Co., Clemson College, low woods, April 16, 1906, *House 1851* (US, NY).

GEORGIA: Thompson's Mills and vicinity, Gwinnett Co., April 8, 1908, *Allard 197* (US); Macon, date lacking, *Green* (ANSP); Stone Mountain, Yellow River, May 3, 1899, *Sargent 69* (G).

ALABAMA: Albertsville, April 22, 1899, *Hosdy* (US); Chickasaw, rich places in the barrens, April, 1919, *Graves 566* (US); Tuskaloosa, April, 1892, *Ward* (US); Auburn, Lee Co., April 22, 1900, *Earle* (G).

MISSISSIPPI: Pass Christian, May 16, 1924, *Cooper* (MBG); Rolling Fork, April, 1895, *Boyce* (US).

LOUISIANA: Feliciana [East or West?] Parish, *Carpenter* (G); east of Baton Rouge, April 20, 1874, *Joor* (F).

INDIANA: banks of the Wabash River, June, 1868, *Allen* (F).

KENTUCKY: Bowling Green, 1903, *Price* (MBG); barrens of Kentucky River near Hopkinsville, date lacking, *Buckley* (MBG).

TENNESSEE: Franklin Co., May 5, 1898, *Eggert* (MBG); Nashville, 1880, *Hubbard 2268* (G).

ILLINOIS: exact locality lacking, 1845, *Mead* (G); Grantsburg, April 28, 1900, collector lacking (P); Conologue, April, 1924, *Woodson* (MBG).

MISSOURI: bank of Meramec River near Windsor Springs, April 19, 1891, *Douglass* (US); Cave Spring, 1887, *Blankinship* (US); Cave Spring, Greene Co., June 18, 1905, *Standley* (US); Tyson, St. Louis Co., May 19, 1918, *Drushel 3757* (MBG); banks of the Meramec River, Minke, St. Louis Co., May 17, 1919, *Greenman 3944* (MBG); Chadwick, May 15, 1907, *Bush 4461* (MBG).

ARKANSAS: Baker Springs, Howard Co., April 10, 1909, *Kellogg* (MBG); data lacking, *Pitcher* (ANSP).

TEXAS: Beaumont, low wet woods, March 16, 1918, *E. J. Palmer 13090* (MBG).

4b. Var. Gattingeri Woodson, n. var.[1]

Herbaceous perennial from a thickened slightly woody root;

[1] Var. Gattingeri var. nov., plus-minusve pilosa varietatem genuinam simulans differt foliis longioribus basi acutis; corollae tubo lanoso.—Tennessee, Nashville, June, year lacking, *A. Gattinger* (Gray Herb. TYPE).

stems 3–10 dm. tall, pubescent, becoming glabrous, somewhat clustered at the base, erect or ascending, branched above, the branches ascending or spreading; leaves relatively distant, alternate, the blades lanceolate to linear-lanceolate above, the lower 5–10 times as long as broad, both base and apex narrowly acute to acuminate, green, pubescent, frequently densely so, becoming glabrous in age; inflorescence compact, many-flowered, pedicels 2–4 mm. long; calyx 2–4 mm. long, the lobes narrowly triangular, glabrous, or with a few scattered hairs; corolla salverform, the tube 7–10 mm. long, densely pubescent or villous without, especially in the sinuses of the lobes, the lobes 5–8 mm. long, lanceolate, spreading; stigmatic-cap much broader than tall, stigma truncate; follicles slender, continuous or very slightly torose, 9–14 cm. long, acuminate, sessile, glabrous, 7–11-seeded; seeds 5–12 mm. long, oblong in outline, truncate or slightly tapered at the ends, variously pitted or wrinkled, brown.

Distribution: woods and ravines, northern Georgia, Tennessee, Illinois, Missouri, southeastern Kansas, eastern Oklahoma, and northeastern Texas.

Specimens examined:

GEORGIA: Jasper City, 1847, *Porter* (G).

TENNESSEE: Nashville, June, year lacking, *Gattinger* (G TYPE, MBG); Nashville, islands in Cumberland River, September, 1878, *Gattinger* (MBG, NY, ANSP, F).

KENTUCKY: barrens of the Kentucky River, exact locality lacking, 1860, *Short* (MBG).

ILLINOIS: Athens, 1861, *Hall* (G, P, MBG); Olney, Richmond Co., Turkey Creek bottoms, May 19, 1914, *Ridgway 104* (G, MBG); Grantsburg, April 28, 1900, *Baker* (P); East Hannibal, June 6, 1913, *Davis 398* (MBG, US); along road west of Fish Lake, St. Clair Co., July 16, 1898, *Norton* (MBG); damp shady thickets, American Bottoms, opposite St. Louis, May, 1845, *Engelmann* (MBG); Queens Lake, Clinton Co., May 20, 1917, *Ledman* (MBG); Venedy, May 18, 1926, *Anderson & Woodson 5* (MBG); Conologue, May 16, 1926, *Woodson & Stevenson 41* (MBG).

MISSOURI: Alba, rich bluff woods, April 29, 1909, *E. J. Palmer 1819* (G, MBG); St. Louis, July 28, 1910, *Sherff 801* (G, F,

MBG); Webb City, gravelly branches, Sept. 2, 1909, *E. J. Palmer 2620* (G, MBG); Winfield, Lincoln Co., June 7, 1916, *Davis 1403* (MBG); Bower's Mill, Lawrence Co., rich hill-side woods, April 22, 1908, *E. J. Palmer* (MBG); Allenton, June 10, 1884, *Kellogg* (MBG); Elmont, May 23, 1914, *Emig* (MBG); Gascondy, July 21, 1914, *Emig 221* (MBG); Gray's Summit, May 15, 1926, *Greenman 4493* (MBG); Allenton, June, 1880, *Letterman* (MBG, US).

ARKANSAS: Benton Co., date lacking, *Plank* (MBG); Eureka Springs, April 27, 1899, *Trelease* (MBG); Little Rock, May, 1886, *Hasse* (F).

OKLAHOMA: Miami, on dry bank of draw, Aug. 26, 1913, *Stevens 2337* (G, MBG, US); Page, on rocky mountain-side, April 25, 1915, *Buckley 3425* (G, MBG); rocky hills, Wichita Mts. not common, July, 1891, *Sheldon 224* (MBG).

5. Amsonia ludoviciana Vail in Small, Fl. Southeast. U. S. ed. 2, 935. 1913.

Herbaceous perennial from a slightly thickened woody root; stems 5–11 dm. tall, pubescent, at least when young, sparingly branched, erect or ascending, the branches erect or ascending; leaves relatively distant, alternate, the blades elliptic, both base and apex acute to acuminate, 5–8 cm. long, essentially glabrous above, densely white-lanose beneath, pedicels 2–4 mm. long; inflorescence relatively dense, several-flowered, pedicels 2–4 mm. long; calyx 2–3 mm. long, the lobes triangular, 1–1.5 mm. long, pubescent; corolla salverform, the tube 5–9 mm. long, densely pubescent or villous without, the lobes about equalling, or slightly exceeding, the tube, lanceolate, spreading; stigmatic-cap about as broad as tall, stigma truncate; follicles slender, continuous, 8–10 cm. long, acuminate, sessile, manifestly pubescent, 6–10-seeded; seeds 5–12 mm. long, oblong-ovoid in outline, truncate at the ends, variously pitted and wrinkled, dark brown.

Distribution: known only from southern Louisiana.

Specimens examined:

LOUISIANA: New Orleans, date lacking, *Ingalls* (NY); Shacky-nody, April, year lacking, *Hale* (NY).

Subgenus II. Sphinctosiphon (K. Schumann) Woodson

Subgenus II. Sphinctosiphon (K. Schumann) Woodson, n. comb.

§*Sphinctosiphon* K. Schumann in Engl. & Prantl, Nat. Pflanzenfam. 4^2: 143. 1895; Dalla Torre & Harms, Gen. Siph. 406. 1904.

Bracteoles conspicuous, giving the inflorescence a chaffy appearance; mouth of the corolla-tube markedly constricted at anthesis; stigma apiculate by two distinct obtuse lobes; follicles continuous, not articulated, fibrous, not horny in texture; seeds oblong in outline, truncate at either end, variously pitted and wrinkled; plants of the southwestern United States and northern Mexico. Spp. 6–13.

Section I. Micranthae Woodson. Corolla-tube 1–1.5 cm. long; calyx 1–4 mm. long; follicles 4–7 cm. long; seeds 4–8 mm. long.

Key to the Species

a. Follicles slender; seeds fertile.
  b. Corolla-lobes 3–6 mm. long, ovate or oblong.
    c. Corolla-lobes 3–4 mm. long; plant entirely glabrous. . . . . *6. A. Palmeri*
    cc. Corolla-lobes 5–6 mm. long; plant pubescent, at least the calyx-lobes.
      d. Stem and leaves glabrous; pedicels 3–5 mm. long; inflorescence loose. . . . . *7. A. pogonosepala*
      dd. Stem and leaves pubescent; pedicels 1–2 mm. long, or practically sessile; inflorescence dense.
        e. Calyx glabrous; inflorescence many-flowered. . . *8. A. hirtella*
        ee. Calyx pubescent; inflorescence few-flowered. . . *9. A. Standleyi*
  bb. Corolla-lobes 6–8 mm. long, lanceolate. . . . . *10. A. latifolia*
aa. Follicles short; seeds sterile. . . . . *11. A. Kearneyana*

6. Amsonia Palmeri Gray, Proc. Am. Acad. **12:** 64. 1877; Gray, Syn. Fl. N. Am. 2^1: 82. 1878. Pl. 52, figs. 14–15.

Amsonia Fremontii Rydb. Bull. Torr. Bot. Club **40:** 465. 1913. *nomen.*

Herbaceous perennial from a somewhat thickened root, glabrous; stems 3–5 dm. tall, usually clustered from the base, erect or slightly ascending, sparingly branched above, the branches ascending; leaves alternate, relatively numerous, oblong-lanceolate to linear-lanceolate above, the blades 2.5–7 cm. long, 4–8 mm. broad; inflorescence relatively few-flowered and loose, held well above the foliage; pedicels 1–3 mm. long, or practically

lacking; calyx 3–4 mm. long, sparsely hairy, the lobes subulate; corolla salverform, the tube constricted at the mouth, 1–1.8 cm. long, the lobes ovate to ovate-oblong, 3–4 mm. long, erect or spreading; stigma apiculate by two distinct obtuse lobes; follicles 4–6 cm. long, acuminate, sessile, glabrous, continuous, 5–10-seeded; seeds 4–8 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, chocolate-brown.

Distribution: Arizona and New Mexico.

Specimens examined:

NEW MEXICO: exact locality lacking, 1851–52, *Wright 1669* (G TYPE, MBG).

ARIZONA: exact locality lacking, 1884, *Lemmon 3248* (G); 50 miles s. of Lee's Ferry, June 12, 1890, *M. E. Jones* (P, US); Hillside, May 1, 1903, alt. 3700 ft., *Jones* (MBG); Beale's Spring, date lacking, *Lemmon & Lemmon* (US); exact locality lacking, 1887, *Mearns 152* (NY).

7. Amsonia pogonosepala Woodson, n. sp.[1]

Herbaceous perennial from a thickened woody root; stems 5–8 dm. tall, glabrous, clustered from the base, erect or slightly ascending, freely branched above, the branches ascending or spreading; leaves alternate, relatively numerous, glabrous, lanceolate to oblong-lanceolate, the blades 1–1.5 cm. broad, 5–7 cm. long, acute to acuminate at both base and apex, petiolate, the petioles 1–3 mm. long; inflorescence loose, relatively many-flowered; pedicels 2–4 mm. long; calyx 3–6 mm. long, the lobes subulate, conspicuously ciliate, 2–5 mm. long; corolla salverform, the tube constricted at the orifice, 12–15 mm. long, glabrous without, the lobes 5–6 mm. long, ovate to oblong, spreading; stigma apiculate by two distinct obtuse lobes; follicles 1.2–8 cm. long, acuminate, sessile, glabrous, continuous, 4–15-seeded; seeds 7–10 mm. long, oblong-truncate in outline, variously pitted or wrinkled, reddish brown.

[1] **Amsonia pogonosepala** sp. nov., humila saepe basaliter ramosa 5–8 dm. alta; ramis erectis vel laxe ascendentibus glabris; foliis lanceolatis oblongo-lanceolatis petiolatis 5–7 cm. longis 1–1.5 cm. latis glabris; lobis calycis piloso-ciliatis subulatis 2–5 mm. longis; corollae lobis ovatis vel ovato-oblongis 5–6 mm. longis tubo subclavato dimidio brevioribus distendatis; stigmate subtrochleari apice bilobato; folliculis teretibus gracilibus continuis glabris sessilibus 2–8 cm. longis.—Arizona, dry rocky hills, San Francisco Mts., April, 1881, *H. H. Rusby 256* (MBG TYPE).

Distribution: southern Arizona.

Specimens examined:

ARIZONA: dry rocky hills, San Francisco Mts., April, 1881, *Rusby 256* (MBG TYPE, ANSP, NY); small sandy wash between Apache Junction and Canyon Lake, June 21, 1928, *Harrison & Peebles 5540* (MBG, US); near Mormon Flats, April 1, 1928, *Peebles, Harrison, & Kearney 3820* (US).

8. Amsonia hirtella Standley, Proc. Biol. Soc. Wash. **26:** 118. 1913; Wooton & Standley, Contr. U. S. Nat. Herb. **19:** 505. 1915.

Herbaceous perennial from a somewhat thickened root, hirtellous; stems 3–5 dm. tall, usually clustered from the base, erect or somewhat ascending, very sparingly branched above, the branches ascending; leaves alternate to subverticillate above, relatively numerous, lanceolate to linear-lanceolate, the blades 3–5 cm. long, 2–5 mm. broad, sessile to subsessile; inflorescence dense, relatively many-flowered; pedicels 1–2 mm. long or practically lacking; calyx 4–5 mm. long, glabrous, except for a few scattered hairs at the tips, the lobes subulate; corolla salverform, the tube constricted at the mouth, 12–15 mm. long, glabrous without, the lobes 5–6 mm. long, ovate to ovate-oblong, slightly spreading; stigma apiculate by two distinct obtuse lobes; follicles unknown.

Distribution: known only from southwestern New Mexico.

Specimens examined:

NEW MEXICO: Grant Co., cañons, May 1, 1892, *Mearns 117* (US TYPE).

9. Amsonia Standleyi Woodson, n. sp.[1] Pl. 52, figs. 16–17.

Herbaceous perennial from a somewhat thickened woody root, densely pubescent; stems 3–5 dm. tall, usually clustered from the base, erect or slightly ascending, freely branched above, the

[1] Amsonia Standleyi sp. nov., pilosa humila saepe basaliter ramosa 3–5 dm. alta; ramis erectis vel laxe ascendentibus; foliis lanceolatis linearibusque plerumque sessilibus 3–7 cm. longis 4–10 mm. latis alternis vel subverticillatis; lobis calycis pilosis lineari-lanceolatis 4–5 mm. longis; corollae lobis ovatis vel ovato-oblongis 5–6 mm. longis tubo subclavato dimidio brevioribus distendatis; stigmate subtrochleari apice bilobato; folliculis teretibus gracilibus continuis glabris sessilibus 6–7 cm. longis.—New Mexico, 1851–52, *C. Wright* (Gray Herb. TYPE).

branches ascending or slightly spreading; leaves alternate to subverticillate above, relatively numerous, lanceolate to linear-lanceolate, the blades 3–7 cm. long, 4–10 mm. broad, narrowed to an inconspicuous petiole, or practically sessile; inflorescence dense, relatively few-flowered; pedicels 1–2 mm. long, or practically lacking; calyx 4–5 mm. long, densely pubescent throughout, the lobes subulate; corolla salverform, the tube constricted at the mouth, 8–10 mm. long, glabrous without, the lobes ovate to ovate-oblong, 5–6 mm. long, spreading; stigma apiculate by two distinct obtuse lobes; follicles 6–7 cm. long, acuminate, sessile, glabrous, continuous, 5–10-seeded; seeds 4–8 mm. long, oblong in outline, truncate at either end, variously pitted and wrinkled, brown.

Distribution: Texas, New Mexico, and Chihuahua.

Specimens examined:

UNITED STATES:

TEXAS: Bofecillos, May 18, 1881, *Havard* (US).

NEW MEXICO: exact locality lacking, 1851–52, *Wright* (G TYPE).

MEXICO:

CHIHUAHUA: Candelaria, Oct. 24, 1911, *Stearns 228* (US).

This species is named in honor of Mr. Paul C. Standley, who provisionally referred the Havard and Stearns specimens, bearing fruit only, to *A. hirtella*, in describing that species, but foresaw that when the flowers corresponding to the fruit should be found they would constitute a new species.

10. Amsonia Jonesii Woodson, new name.

Amsonia latifolia M. E. Jones, Contr. West. Bot. **12**: 50. 1908, not Michx.; Rydb. Fl. Rocky Mts. 668. 1917; Tidestrom, Contr. U. S. Nat. Herb. **25**: 418. 1925.

Amsonia texana Rydb. Fl. Rocky Mts. 668. 1917, not Heller.

Herbaceous perennial from a thickened, frequently very woody root, glabrous; stems 2–4 dm. tall, usually much clustered from the base, erect or ascending, sparingly branched, the branches ascending; leaves alternate, numerous, ovate to ovate-oblong, glaucous, the blades 3–5 cm. long, 1–2 cm. broad, petiolate; inflorescence dense, relatively many-flowered; pedicels 3–5 mm.

long; calyx about 1.5 mm. long, the lobes triangular; corolla salverform, 5–8 mm. long, the lobes narrowly oblong-lanceolate, 5–7 mm. long, spreading, slightly pubescent at the tips when in aestivation; stigma apiculate by two distinct obtuse lobes; follicles 5–8 cm. long, acuminate, sessile, glabrous, continuous, 4–8-seeded; seeds 4–6 mm. long, oblong in outline, transversely truncate at either end, variously pitted and sculptured, brown.

Distribution: rocky gorges and canons, southwestern Colorado, southeastern Utah, and northeastern Arizona.

Specimens examined:

COLORADO: Grand Junction, alt. 4500 ft., June 21, 1894, *M. E. Jones 5469* (P); Grand Junction, alt. 4000 ft., May 28, 1895, *M. E. Jones* (P); McElmo Creek, Montezuma Co., July 19, 1895, *Eastwood 72* (G, MBG); Grand Junction, June 21, 1894, *Jones 5476q* (MBG, ANSP, US, NY).

UTAH: Monroe, Sevier Co., alt. 5000 ft., May 24, 1894, *M. E. Jones 6446* (P TYPE, MBG).

ARIZONA: Navajo Wells, alt. 5000 ft., May 24, 1894, *M. E. Jones 5289aa* (P, MBG); Pagumpa, alt. 4000 ft., April 21, 1894, *M. E. Jones 5093* (P, US, NY, MBG).

11. Amsonia Kearneyana Woodson, n. sp.[1]

Herbaceous perennial from a thickened, somewhat woody root, more or less pilose; stems 4–8 dm. tall, usually clustered from the base, erect or ascending, sparingly branched, the branches ascending; leaves alternate to subverticillate, oblong-lanceolate to lanceolate, 4–7 cm. long, 1–1.5 cm. broad, petiolate, or subsessile; inflorescence dense, many-flowered; pedicels 1 mm. long or practically lacking; calyx 3–5 mm. long, the lobes subulate-aristate, densely pilose-ciliate; corolla salverform, the tube constricted at the orifice, 1–1.2 cm. long, the lobes 3–5 mm. long, oblong to ovate, erect or slightly spreading; stigma apiculate by two distinct obtuse lobes; follicles short and obviously de-

[1] Amsonia Kearneyana sp. nov., plus-minusve pilosa basaliter ramosa 4–8 dm. alta; ramis ascendentibus; foliis alternis vel subverticillatis subsessilibus oblongo-lanceolatis 4–7 cm. longis 1–1.5 cm. latis; lobis calycis subulato-aristatis 3–5 mm. longis; corollae tubo longo subclavato 1–1.2 cm. longo lobis ovatis 3–5 mm. longis erectis vel ascendentibus; stigmate subtrochleari apici bilobato; folliculis deformis; seminibus sterilibus.—Arizona, Pima Co., South Cañon, April 9, 1928, *F. Thackery 55* (MBG TYPE).

formed but essentially continuous, 2–5 cm. long, 5–7 mm. broad; seeds sterile.

Distribution: southern Arizona.

Specimens examined:

Arizona: South Canyon, Baboquivari Mts., May 24, 1926, *Thackery 2018* (US, MBG); South Canyon, Baboquivari Mts., March 29, 1927, *Peebles, Harrison & Kearney 3820* (US, MBG); South Cañon, Pima Co., April 9, 1928, *Thackery 55* (MBG type).

Because of its appearance intermediate between *A. Standleyi* or *A. Palmeri* and *A. brevifolia* or *A. tomentosa*, because of its geographical position, and because of its complete sterility, *A. Kearneyana* is regarded as a natural hybrid between the subgenera *Sphinctosiphon* and *Articularia*. The flowers are decidedly of the type of *A. Palmeri*, with oblong-ovate, erect or ascending corolla-lobes, while the broad foliage is very similar to that of *A. brevifolia* or *A. tomentosa*. However, since several colonies have been found in the same general vicinity, it is thought better to consider it as a distinct species in the light of recent opinions concerning the origin of species by means of hybridization. Since it demonstrates its recent creation by its sterility and its irregular pilosity, it should probably be considered the most recently evolved species of the genus *Amsonia*.

A. Kearneyana is so named in honor of Mr. T. H. Kearney, of the United States Bureau of Plant Industry, who brought the plant to the attention of the author, and furnished much valuable information regarding the genus in Arizona.

Section II. Longiflorae Woodson. Corolla-tube 3–4 cm. long; calyx 4–8 mm. long; follicles 7–9 cm. long; seeds 5–12 mm. long.

Key to the Species

a. Plant glabrous; corolla-lobes 11–13 mm. long ..... *12. A. longiflora*
aa. Plant pubescent; corolla-lobes 5–7 mm. long ..... *13. A. salpignantha*

12. Amsonia longiflora Torr. Bot. Mex. Bound. Surv. 159. 1859; Gray, Syn. Fl. N. Am. **2**[1]: 82. 1878; Hemsley, Biol. Cent.-Am. Bot. **2**: 308. 1881; Wooton & Standley, Contr. U. S. Nat. Herb. **19**: 504. 1915. Pl. 52, figs. 18–20.

Herbaceous perennial from a thickened somewhat woody root,

glabrous; stems 3.5–6 dm. tall, usually clustered from the base, erect or ascending, copiously branched at maturity, the branches ascending or spreading; leaves alternate to subverticillate, linear-lanceolate to filiform, 2.5 cm. long, 1–2 mm. broad, sessile; inflorescence relatively loose, usually containing only 5–10 flowers; pedicels 2–5 mm. long; calyx 6–8 mm. long, the lobes subulate-aristate; corolla trumpet-shaped, the tube constricted at the mouth, 3–4 cm. long, the lobes 11–13 mm. long, oblong-lanceolate, spreading; stigma apiculate by two distinct obtuse lobes; follicles slender, continuous, 7–9 cm. long, acuminate, sessile, 5–15-seeded; seeds 5–10 mm. long, elliptic-oblong in outline, truncate at either end, variously pitted or wrinkled, brown.

Distribution: southeastern New Mexico, extreme western Texas, and north-central Mexico.

Specimens examined:

UNITED STATES:

TEXAS: El Paso, 1881, *Vasey* (G, US, MBG); Hood Co., dry rocky prairie, Sept. 5, 1903, *Reverchon 3881* (MBG); El Paso, April, 1852, *Parry* (MBG); El Paso, rocky ravines, *Wright 1168* (G, NY TYPE, MBG); data lacking, *Wright 72* (NY).

NEW MEXICO: base of Sacomento Mt., Alamogordo, April 14, 1902, *Rehn & Viereck* (ANSP); in arroyo, base of foothills, Alamogordo, May 19, 1902, *Rehn & Viereck* (ANSP); Rio Gila, Aug. 15, 1902, *Wooton* (US).

ARIZONA: Sonoika Creek, south of Patagonia, April 15, 1908, *Tidestrom 848* (US).

MEXICO:

DURANGO: vicinity of the city of Durango, April–Nov., 1896, *E. Palmer 90* (G, MBG, NY).

13. Amsonia salpignantha Woodson, n. sp.[1] Pl. 52, figs. 21–22.

Herbaceous perennial from a thickened somewhat woody root,

[1] **Amsonia salpignantha** sp. nov., pilosa vel scabra basaliter ramosa 2–3.5 dm. alta; ramis erectis vel ascendentibus; foliis multis alternis vel subverticillatis sessilibus lineari-lanceolatis filiformibusque 2–5 cm. longis .5–4 mm. latis; lobis calycis lineari-lanceolatis 4–5 mm. longis; corollae tubo longo subclavato 3–4 cm. longo; corollae lobis ovatis 5–7 mm. longis distendatis; stigmate subtrochleari apici bilobato; folliculis teretibus gracilibus continuis glabris sessilibus 7–9 cm. longis.—Texas, Hamilton Co., rocky prairies on the Cowhouse Creek, May, 1884, *J. Reverchon 1557* (MBG TYPE).

pubescent, scabrous in age; stems 2–3.5 dm. tall, usually clustered from the base, erect or ascending, branched, the branches ascending; leaves numerous, alternate to subverticillate, linear-lanceolate to filiform, 2–5 cm. long, .5–4 mm. broad, sessile; inflorescence relatively dense, containing usually 10–30 flowers; pedicels 1–4 mm. long, or practically lacking; calyx 4–5 mm. long, the lobes subulate or narrowly lanceolate; corolla trumpet-shaped, the tube constricted at the mouth, 3–4 cm. long, glabrous without, the lobes 5–7 mm. long, oblong-ovate, spreading; stigma apiculate by two distinct obtuse lobes; follicles slender, continuous, 7–9 cm. long, acuminate, sessile, 5–15-seeded; seeds 5–12 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, brown.

Distribution: southwestern Texas and Chihuahua.

Specimens examined:

United States:

Texas: Hamilton Co., 1885, *Reverchon 99* (G, MBG); exact locality and date lacking, *Pope* (G); rocky prairies on the Cowhouse Creek, Hamilton Co., May, 1884, *Reverchon 1557* (F, MBG type); Limpio Mts., 1883, *Havard* (US); Austin, 1880, *Oberwetter* (US); Del Rio, Dec. 7, 1891, *Plank* (NY).

Mexico:

Chihuahua: exact locality lacking, 1852, *Wright 1671* (G).

Subgenus III. Articularia Woodson

Subgenus III. Articularia Woodson, n. subgen.

§*Sphinctosiphon* K. Schumann in Engl. & Prantl, Nat. Pflanzenfam. 4²: 143. 1895, in part; Dalla Torre & Harms, Gen. Siph. 406. 1904, in part.

Bracteoles conspicuous, giving the inflorescence a somewhat chaffy appearance; mouth of the corolla-tube markedly contracted in anthesis; stigma apiculate by two distinct obtuse lobes; follicles torose, articulated into thickish constricted segments, horny, not fibrous in texture; seeds elliptic in outline, rounded or pointed at the ends, rarely truncate, relatively smooth and corky; plants of the southwestern United States and northern Mexico. Spp. 14–17.

KEY TO THE SPECIES

a. Plant glabrous, or with but scattered hairs.
  b. Leaves ovate to ovate-lanceolate above; corolla-tube about 10 mm. long.....*14. A. brevifolia*
  bb. Leaves lanceolate to linear above; corolla-tube about 15 mm. long. .....*15. A. Eastwoodiana*
aa. Plant villous or tomentose.
  b. Leaves ovate to ovate-lanceolate, petiolate.....*16. A. tomentosa*
  bb. Leaves lanceolate to linear, sessile or subsessile.....*17. A. arenaria*

14. Amsonia brevifolia Gray, Proc. Am. Acad. **12**: 64. 1877; Gray, Syn. Fl. N. Am. **2**[1]: 81. 1878; Watson, Bot. Cal. **2**: 462. 1880; Coville, Contr. U. S. Nat. Herb. **4**: 142. 1893; Wooton & Standley, Contr. U. S. Nat. Herb. **19**: 505. 1915; Rydb. Fl. Rocky Mts. 668. 1917; Davidson & Moxley, Fl. South. Cal. 278. 1923; Tidestrom, Contr. U. S. Nat. Herb. **25**: 418. 1925; Jepson, Man. Fl. Pl. Cal. 768. 1925. Pl. 53, figs. 26–28.

Herbaceous perennial from a thickened fibrous root, glabrous; stems 1.5–3.5 dm. tall, usually clustered from the base, erect or ascending, sparingly branched; leaves alternate, numerous, ovate-oblong to oblong-lanceolate, 2–3 cm. long, .5–1.5 cm. broad, acute to acuminate at either end; inflorescence dense, much divided at maturity; pedicels .5–1.5 mm. long or practically lacking; calyx 2–4 mm. long, the lobes subulate, bluish tinted; corolla salverform, the tube constricted at the mouth, 7–10 mm. long, the lobes ovate to ovate-oblong, 4–6 mm. long, spreading; stigma apiculate by two distinct obtuse lobes; follicles 5–7 cm. long, torose, articulated into thickish constricted segments, sessile, glabrous, 3–10-seeded; seeds 5–7 mm. long, elliptic-lanceolate in outline, sharply truncate at one or both ends, never tapering sharply, 8–10 mm. long, 3.5–4 mm. broad, smooth or slightly wrinkled, yellowish-brown.

Distribution: deserts and mountain slopes, southwestern Utah, northwestern Arizona, southern Nevada, and southern California.

Specimens examined:

UTAH: Kanab, Logan Co., 1872, *Thompson* (G); exact locality and date lacking, 1874, *Parry* (G); Garfield Co., 1883, *Siler* (ANSP).

ARIZONA: Mokiah Pass, 1877, *E. Palmer 302* (G TYPE).

Nevada: Eldorado Cañon at Nelson, alt. 3000 ft., April 30, 1907, *M. E. Jones* (P); 22 miles south of Searchlight, March 26, 1924, *Jaeger* (P); Las Vegas, June, 1915, *K. Brandegee* (P); Ashmeadows, alt. 3000–4000 ft., May–Oct. 1898, *Purpus 5988* (P); Cottonwood Springs, Las Vegas Valley, April 30, 1891, *Bailey 1885* (US).

California: Mojave region, June, 1876, *E. Palmer 435* (G, MBG, ANSP, US); Mojave Desert near San Bernardino, 1880, *Lemmon* (G); Colorado Desert, in desert sands, April 24, 1921, *Spencer 1778* (G); San Bernardino, May, 1882, *Parish 1332* (G, MBG, US); San Bernardino Co., north slope of San Bernardino Mts., alt. 4000–6000 ft., June 15, 1895, *Parish 3765* (G); Hesperia, in desert sand, Mojave Desert, alt. 3100 ft., May 8, 1917, *Spencer 347* (G, P); Kelso, alt. 3000 ft., May 2, 1906, *M. E. Jones* (P); Keyes' Ranch, alt. 3500 ft., common along a wash, May 7, 1922, *Munz & Johnston 5253* (Baker); Corn Springs, rocky slope, high gorge, alt. 2500 ft., *Munz & Keck 4843* (Baker); Goffs, Mohave Desert, March 28, 1924, *Jaeger* (P); entrance to Deep Creek, slope of San Bernardino Mts., alt. 3500 ft., May 9, 1921, *Jaeger 288* (Baker); Quail Springs, Morango Pass, alt. 4000 ft., April 30, 1921, *Munz 4535* (Baker); Cactus Flat, San Bernardino Co., alt. 6000 ft., June 25, 1926, *Munz 10505* (Baker); Cotton-wood Springs, E. Riverside Co., March 26, 1926, *Jaeger* (P); Cushenberry Canyon, San Bernardino Co., June 1, 1892, *Parish 2411* (F); Willow Creek Mt., Panamint Mts., May 22, 1891, *Coville & Funston 825* (US); Mojave Desert, April–May, 1906, *Saunders* (ANSP); Cottonwood Pass, Riverside Co., May, 1905, *Hall 6006* (US); same locality, April 12, 1924, *Evermann* (MBG).

As an instance of the manner in which specific criteria have been applied in the present paper, the case of the specific individuality of *A. brevifolia* Gray and *A. tomentosa* Torr. & Frém. may be of interest, particularly to southwestern botanists. The two species mentioned are both members of the subgenus *Arthiculariа* and inhabit portions of southern California, southern Nevada, and southwestern Utah, and are seldom found separately. Jepson,[1] in 1925, came to the decision that they rep-

[1] Jepson, W. L. Man. Fl. Pl. Cal. 768. 1925.

resented variation only, and reduced *A. tomentosa* to a variety of *A. brevifolia*, although if either should be reduced, the former should remain since it antedates the latter by thirty-two years. The important difference between the two species is the remarkable pubescence of *A. tomentosa*, a character which is not known to vary, judging from the copious herbarium material which the writer has been privileged to examine. *A. tomentosa* is always remarkably pubescent, even to the mature follicles, while *A. brevifolia* is always found to be completely glabrous. Moreover, the seeds of the two species are distinct, a fact which is evidently little appreciated. The seeds of *A. brevifolia* are sharply truncate at one or both ends and never taper sharply, measuring 8–10 mm. long and 3.5–4 mm. broad. The seeds of *A. tomentosa* taper decidedly at both ends and are slightly arcuate, measuring from 12 to 13 mm. long and 3 to 4 mm. broad. Illustrations of the seeds are to be found in pl. 53. In the presence of the seed difference and the non-intergradation of the pubescence or glabrousity of the two species, it has been thought advisable to treat the species as representing a striking affinity rather than as varieties.

15. A. Eastwoodiana Rydb. Bull. Torr. Bot. Club **40**: 465. 1913; Rydb. Fl. Rocky Mts. 668. 1917; Tidestrom, Contr. U. S. Nat. Herb. **25**: 418. 1925.

Herbaceous perennial from a thickened fibrous-woody root, glabrous; stems clustered from the base, 3–5 dm. tall, erect or ascending, branched from near the base, the branches ascending or spreading; leaves alternate, rather distant, oblong-lanceolate below to linear-lanceolate above, 3–5 cm. long, .3–1 cm. broad, acute at either end, subsessile; inflorescence relatively small, loose; pedicels 4–7 mm. long; calyx 2–2.5 mm. long, the lobes subulate; corolla salverform, the tube constricted at the mouth, 1–2 cm. long, the lobes 4–6 mm. long, oblong, spreading; stigma apiculate by two distinct obtuse lobes; follicles 5–8 cm. long, torose, articulated into thickish constricted segments, sessile, glabrous, 3–5-seeded; seeds elliptic in outline, tapered at one or both ends, 14–15 mm. long, 4–5 mm. broad, smooth or slightly wrinkled, reddish brown.

Distribution: stream margins and ravines, Utah and Arizona.

Specimens examined:

UTAH: San Juan Co., Willow Creek, July 14, 1895, *Eastwood 73* (G, MBG); San Rafael Swell, Emery Co., May 12, 1914, *M. E. Jones* (P); Moab, June 6, 1913, *M. E. Jones* (P); 10 miles east of Holbrook, June 22, 1901, *Ward* (NY TYPE, US).

ARIZONA: Lee's Ferry, June 13, 1890, *M. E. Jones* (P, MBG); Kayenta, 1922, *Weatherill* (NY).

16. Amsonia tomentosa Torr. & Frém. in Frém. Rept. 1843–44, 316. 1845; Walpers, Ann. Bot. Syst. **1**: 504. 1849; Rept. Torr. Bot. Mex. Bound. Surv. 158. 1859; Gray, Syn. Fl. N. Am. **2**[1]: 81. 1878; Hemsley, Biol. Cent.-Am. Bot. **2**: 308. 1881; Rydb. Fl. Rocky Mts. 668. 1917; Davidson & Moxley, Fl. South. Cal. 278. 1923; Tidestrom, Contr. U. S. Nat. Herb. **25**: 418. 1925. Pl. 53, figs. 23–25.

Amsonia brevifolia Gray var. *tomentosa* (Torr. & Frém.) Jepson, Man. Fl. Pl. Cal. 768. 1925.

Herbaceous perennial from a slightly woody root, densely tomentose; stems 3–4 dm. tall, usually clustered at the base, erect or ascending, branched, the branches ascending or spreading; leaves alternate, rather numerous, ovate-oblong below to oblong-lanceolate above, 2–4 cm. long, 1–1.5 cm. broad, acute at either end, the apices of the upper leaves conspicuously attenuate; inflorescence small, very dense, usually held well above the foliage; pedicels .5–2 mm. long or practically lacking; calyx 2–3 mm. long, the lobes subulate; corolla salverform, the tube 5–8 mm. long, markedly constricted at the mouth, the lobes 4–7 mm. long, ovate to oblong, spreading; stigma apiculate by two distinct obtuse lobes; follicles 6–8 cm. long, articulated into thickish constricted segments, sessile, conspicuously tomentose, 3–7-seeded; seeds elliptic in outline, sharply tapering at both ends, and slightly arcuate, 12–13 mm. long, 3–4 mm. broad, reddish-brown.

Distribution: mountain slopes and deserts, southern Nevada and southern California.

Specimens examined:

NEVADA: Eldorado Canon at Nelson, alt. 3000 ft., April 30, 1907, *M. E. Jones* (P).

CALIFORNIA: Cactus Ranch, Cushenberry Canon, San Bernardino Co., alt. 5500 ft., June 1, 1892, *Parish 2412* (G); Mojave Desert, San Bernardino Co., June 5, 1915, *Parish 10244* (G); San Bernardino Co., north slopes San Bernardino Mts., alt. 4000–6000 ft., June 15, 1895, *Parish 3769* (G); Colorado Desert, in desert sands, alt. 3190 ft., 1921, *Spencer 1778a* (G); One-thousand Palms Canon, upper portion Colorado Desert, April 1, 1921, *Jaeger 60* (Baker); Kelso, alt. 4000 ft., May 2, 1906, *M. E. Jones* (P, MBG); One-thousand Palms Canon, alt. 2700 ft., April 10, 1921, *Jaeger 1173* (Baker); Keyes' Ranch, alt. 3500 ft., common along wash, May 7, 1922, *Munz & Johnston 5252* (Baker); vicinity of Corn Springs, Chuckwalla Mts. Colorado Desert, rocky slope in high gorge, alt. 2500 ft., April 9–12, 1922, *Munz & Keck* (Baker).

17. Amsonia arenaria Standley, Proc. Biol. Soc. Wash. **26**: 118. 1913; Wooton & Standley, Contr. U. S. Nat. Herb. **19**: 505. 1915. Pl. 53, figs. 29–30.

Herbaceous perennial from a thickened slightly woody root, tomentose; stems 2–4 dm. tall, clustered from the base, erect or ascending, branched, the branches short, ascending; leaves numerous, crowded, alternate to subverticillate, sessile, linear-lanceolate to filiform, slightly fleshy, the midveins usually furrowed, 4–6 cm. long, 1–5 mm. wide; inflorescence dense, not usually held above the foliage; pedicels .5–3 mm. long or practically lacking; calyx 4–7 mm. long, the lobes subulate; corolla salverform, the tube 8–10 mm. long, the lobes ovate-oblong to ovate-lanceolate, 5–8 mm. long, spreading; stigma apiculate by two distinct obtuse lobes; follicles glabrous, 5–8 cm. long, torose, articulated into 2–7 thickish constricted segments, sessile, glabrous, 2–7-seeded; seeds 1–1.5 cm. long, elliptic-arcuate in outline, sharply tapering at both ends, 3–4 mm. broad, nearly smooth, light brown.

Distribution: gravelly plains and mountain slopes; Texas, New Mexico, Arizona, and Chihuahua.

Specimens examined:

UNITED STATES:

TEXAS: exact locality lacking, 1857, *Thurber 138* (F).

NEW MEXICO: San Andreas Mts., 1913, *Wooton* (G, US); exact locality lacking, 1852, *Wright 1670* (G, MBG); Turney Range, Dona Ana Co., Sept. 23, 1912, *Wooton* (US); Strauss, rolling hills, 1912, *Stearns* (MBG).

ARIZONA: Cameron, infrequent, sand, June 7, 1922, *Hanson 160* (F); same locality, along wash, June 8, 1922, *Hanson 159* (MBG).

MEXICO:

CHIHUAHUA: between Laguna de Guzman and Laguna Santa Maria, July 16, 1891, *Hartmann 724* (G); gravelly plains near Lake Guzman, alt. 4000 ft., April 9, 1898, *Pringle 6796* (G, P, MBG); among rocks, Ojo de Vaca to Los Plagas, June, 1851, *Thurber 315* (G).

SPECIES EXCLUDED

Amsonia orientalis Decne. in Jacquemont, Voy. Ind. **4**: 105. 1841 = **Rhazya orientalis** (Decne.) A. DC. in DC. Prodr. **8**: 386. 1844.

LIST OF EXSICCATAE

The distribution numbers are printed in *italics*. The number in parentheses is the species number in this revision.

Albrecht, N. — (3).
Allard, H. A. *197* (4a).
Allen, T. F. — (4a).
Anderson, E. S. & Woodson, R. E., Jr. *5* (4b); *4000* (2a).
Arséne, Bro. — (2a).
Bailey, V. *1885* (15).
Baker, C. F. — (4b).
Bartlett, H. H. *1493* (2a).
Bartram, E. B. — (4a).
Berg, N. K. — (2).
Biltmore Herb. *81*, *81b* (4a).
Blakely, G. *3425* (4).
Blankinship, J. W. — (4a).
Boyce, S. S. — (4a).
Brandegee, K. — (14).
Bray, W. L. *60*, *239* (2).
Brown, O. E. — (4).
Buckley, S. B. — (2a); — (4a).
Bush, B. F. *646* (2b); *11*, *753*, *2378*, *7513* (4); *4461* (4a).
Canby, W. M. *68* (2).
Carpenter, — (4a).
Chapman, A. W. — (1); — (2); — (2a).
Clemens, Mrs. J. *11727* (2b).
Commons, A. — (4).
Cooper, C. H. — (4a).
Coville, F. V. & Funston, F. *825* (14).
Curtis, M. A. — (1); — (2); — (2a); — (4a).
Curtiss, A. H. *6820* (1); *2269*, *6376* (2); *6476* (2a).
Davis, J. *398*, *1403* (4b).
Donnell-Smith, J. — (2a); — (4).
Douglass, E. — (4a).
Drushel, J. A. *4572* (2); *3757* (4a).
Durand, A. — (2).
Earle, F. S. — (4a).
Eastwood, A. *72* (10); *73* (15).
Edward, K. — (4).
Eggert, H. — (2); — (2b); — (4a).
Emig, W. H. *399* (2b); — (4b).
Engelmann, G. — (4); — (4b).

Evermann, B. W. — (14).
Faxon, C. E. — (4a).
Fell, M. — (2a).
Gallup, L. *4* (4).
Gattinger, A. — (4b).
Glatfelter, J. M. — (4).
Graves, E. W. *566* (4a).
Green, J. N. — (2a); — (4a).
Greenman, J. M. *3944* (4a); *4493* (4b).
Hale, — (5).
Hall, E. *515* (2b); — (4b).
Hall, H. M. *6006* (14).
Hanson, H. C. 159, 160 (17).
Harper, R. M. *440*, *448*, *606* (1); *1319* (2); *577*, *915*, *1166*, *2138* (2a).
Harrison, G. J. & Peebles, R. H. *5540* (7).
Hartmann, C. V. *724* (17).
Harvey, F. L. *38* (4).
Hasse, —. — (4b).
Havard, V. — (9); — (13).
Hitchcock, A. S. — (2a); *76a* (4).
Hopkins, M. H. *83* (2a).
Hosdy, J. B. — (4a).
Houghton, M. *3606* (2b).
House, H. D. *1851* (4).
Hubbard, G. W. *2268* (4a).
Huger, A. M. — (2a).
Hyams, M. E. — (4a).
Ingalls, T. J. — (5).
Jaeger, E. C. — (14); *288* (14); *60*, *1173* (16).
Jermy, G. *145* (2b).
Jones, M. E. — (6); —, 5289aa, 5469, 5093, 5476q, 6446 (10); — (14); — (15); — (16).
Joor, J. F. — (4a).
Kellogg, J. H. — (4a); — (4b).
Knowlton, C. H. — (4).
Ledman, O. S. — (4b).
Lemmon, J. G. *3248* (6); — (14).
Lemmon, J. G. & Lemmon, — (6).
Letterman, G. W. — (2a); — (4b).
Lindheimer, F. — (2b); *660*, *4* (2b).
Martindale, J. C. —, *4864* (4).
Matsumura, J. — (3).
Maximowicz, K. J. — (3).
Mead, S. B. — (4a).
Mearns, E. A. *152* (6); *117* (8).
Meislahn, M. *210* (2a).
Millspaugh, C. F. *4030* (4a).
Mohr, C. — (2a).
Munz, P. A. *4535*, *10505* (14).
Munz, P. A. & Johnston, I. M. *5253* (14); *5252* (16).
Munz, P. A. & Keck, D. *4843* (14); — (16).
Nash, G. V. *2546* (2a).
Nehrling, H. *12* (2a).
Norton, G. B. S. — (4b).
Oberwetter, P. H. — (13).
Olney, S. T. & Metcalfe, J. *76* (2).
Painter, J. H. — (4).
Palmer, E. *90* (12); *302*, *435* (14).
Palmer, E. J. *27233* (2); *33031* (2a); *11471*, *11616*, *12233*, *12262*, *12597*, *13496*, *24203* (2b); *12*, *818*, *921*, *4305*, *8286* (4); *13090* (4a); —, *1819*, *2620* (4b).
Parish, S. B. *1332*, *2411*, *3765* (14); *2412*, *3769*, *10244* (16).
Parry, C. C. — (12); — (14).
Peebles, R. H., Harrison, G. J. & Kearney, T. H. *3820* (11); *5258* (15).
Pitcher, — (4a).
Plank, E. N. — (2); — (4b); — (13).
Pope, J. — (13).
Porter, T. C. — (2a); — (4b).
Price, S. F. — (4a).
Pringle, C. G. *6796* (17).
Purpus, C. A. *5988* (14).
Ravenel, H. W. — (2).
Rehn, J. A. G. & Viereck, H. L. — (12).
Reverchon, J. *84* (2a); —, *598*, *3122* (2b); *3881* (12); *99*, *1557* (13).
Ridgway, R. *104* (4b).
Rodman, M. — (2).
Rugel, F. — (1); *21* (2a).
Rusby, H. H. *256* (7).
Ruth, A. *241* (2b); *174*, *466*, *480* (4).
Sargent, C. S. — (2); *69* (4a).
Saunders, C. F. — (14).
Seymour, A. B. *1584* (4).
Sheldon, C. S. *224* (4b).
Sherff, E. *801* (4b).
Short, C. W. — (4b).

Siler, A. L. — (14).
Smith, A. H. — (4a).
Spencer, M. F. *1778*, *347* (14); *1778a* (16).
Standley, P. C. — (4a).
Stanfield, S. W. — (2).
Stearns, E. *228* (9); — (17).
Stevens, G. W. *29* (2b); *2670* (4); *2337* (4b).
Sydone, O. — (2b).
Taylor, K. A. — (2).
Thackery, F. H. *2018* (11).
Thompson, Mrs. A. P. — (14).
Thurber, G. *138*, *315* (17).
Tidestrom, I. *848* (12).
Townsend, E. C. — (4a).
Tuomey, M. — (4a).
Vail, W. *546* (4).
van der Velden, A. & W. — (2).
Vasey, G. R. — (12).
Ward, L. F. — (4a); — (15).
Weatherill, J. — (15).
Wells, E. — (4).
Wilkins, T. — (2).
Williams, E. F. — (4).
Williamson, C. S. — (2a); — (4a).
Woodson, R. E., Jr. — (4a).
Woodson, R. E., Jr. & Stevenson, J. *41* (4b).
Wooton, E. O. — (12); — (17).
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Young, M. S. — (2b).

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New subgenera, sections, species, varieties, and combinations are printed in **bold face** type; synonyms in *italics;* and previously published names in ordinary type.

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Explanation of Plate

PLATE 50

Map of the geographical distribution of *Amsonia* in North America.

oooo subgenus *Euamsonia* (K. Schumann) Woodson.

— *A. Tabernaemontana.*
— — *A. ciliata.*
—·— *A. rigida.*
····· *A. ludoviciana.*

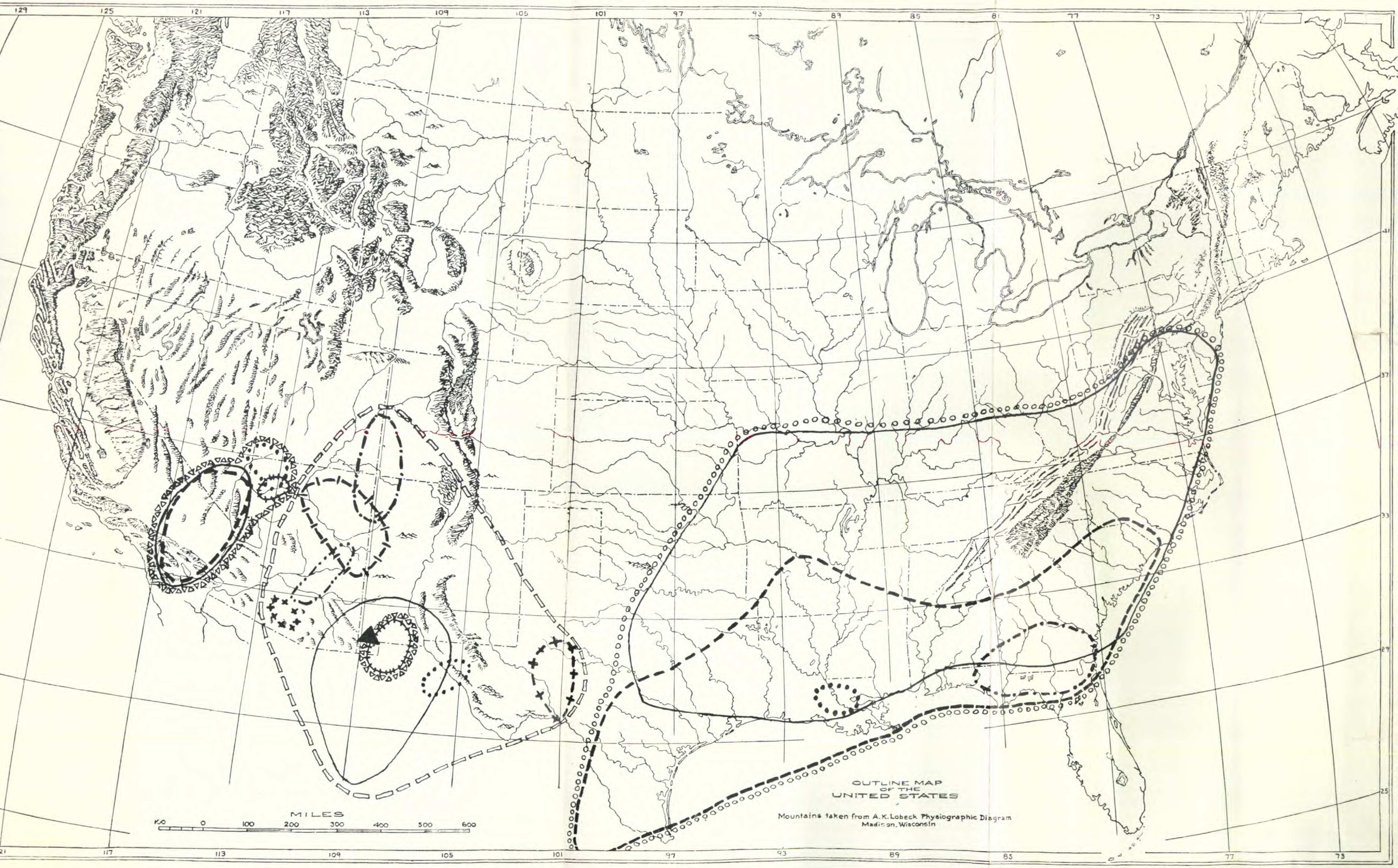
▭▭▭ subgenus *Sphinctosiphon* (K. Schumann) Woodson.

—|— *A. Palmeri.*
···· *A. Standleyi.*
+++ *A. Kearneyana.*
—— *A. longiflora.*
—+— *A. salpignantha.*
—·— *A. Jonesii.*
▲ *A. hirtella.*

▽△▽△▽ subgenus *Articularia* Woodson.

—— *A. brevifolia.*
— — *A. tomentosa.*
•••• *A. Eastwoodiana.*
+++++ *A. arenaria.*

NOTE: Since the preparation of Plate 50, *Amsonia ciliata* var. *tenuifolia* has been found locally in extreme south-central Missouri (*E. J. Palmer 33031; Anderson & Woodson 4000*), thus extending the known distribution of that species from central Arkansas.


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MILES
K.0 0 100 200 300 400 500 600
OUTLINE MAP
OF THE
UNITED STATES
Mountains taken from A.K. Lobeck Physiographic Diagram
Madison, Wisconsin

Explanation of Plate

PLATE 51

Illustrations of the subgenus *Euamsonia*, with comparison to *Haplophyton;* all figures × 2 except when otherwise noted.

Haplophyton cimicidium A. DC.

Fig. 1. Flower. × 1.
Fig. 2. Front and side of stamen.
Fig. 3. Pistil.

A. rigida Shuttlew.

Fig. 4. Flower.
Fig. 5. Front and side of stamen.
Fig. 6. Pistil.

A. ciliata Walt.

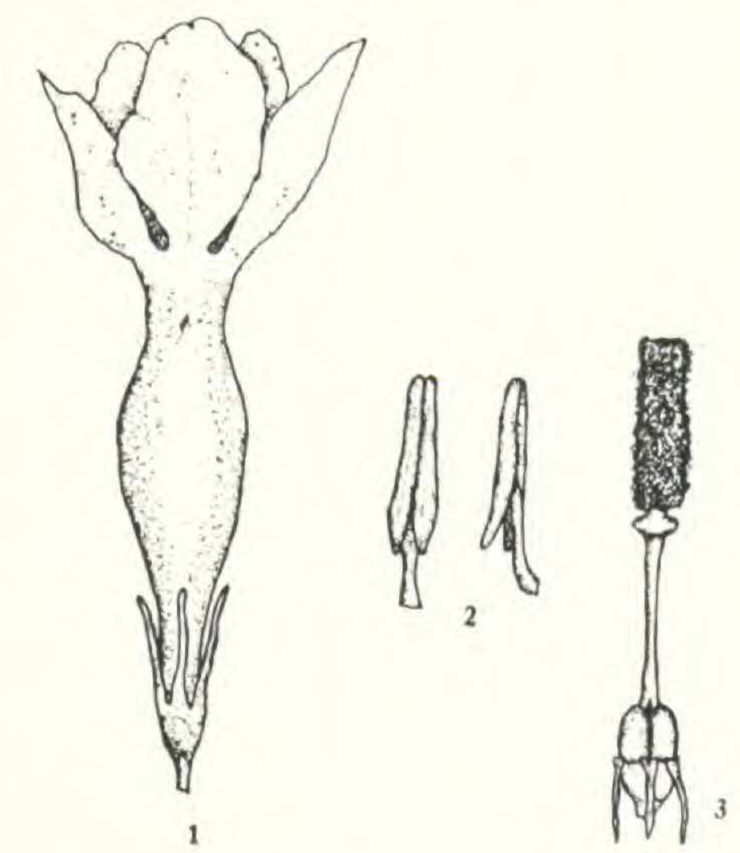
Fig. 7. Flower.
Fig. 8. Pistil.

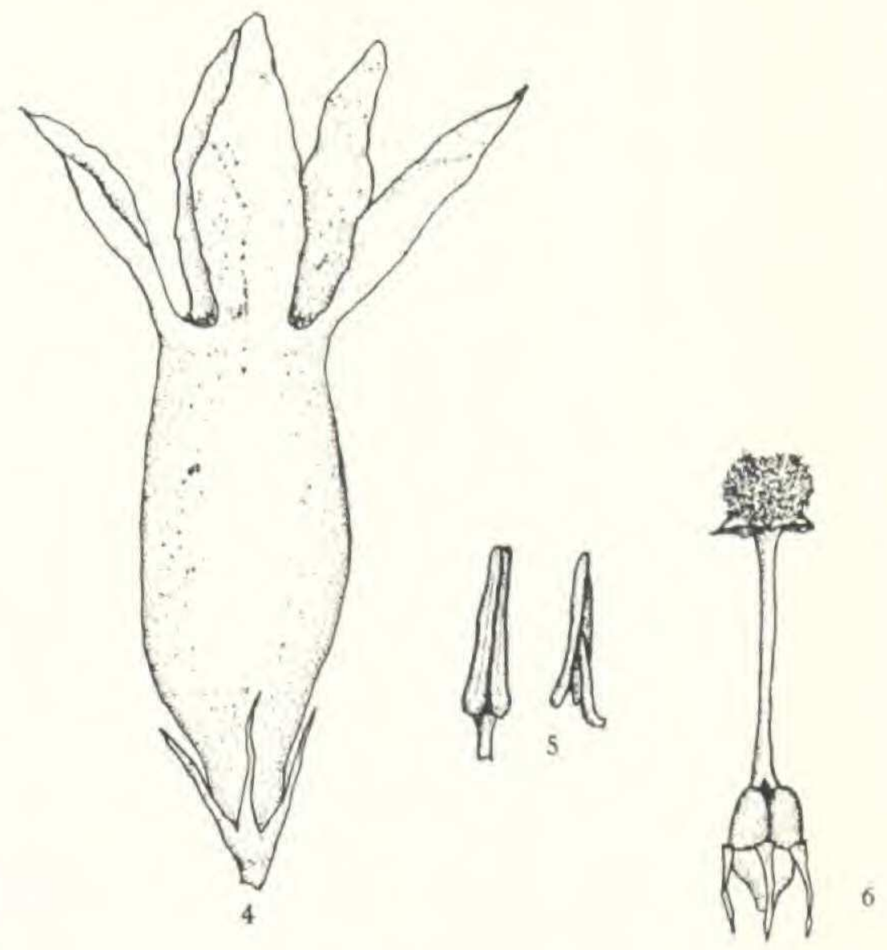
A. elliptica (Thunb.) Roem. & Schult.

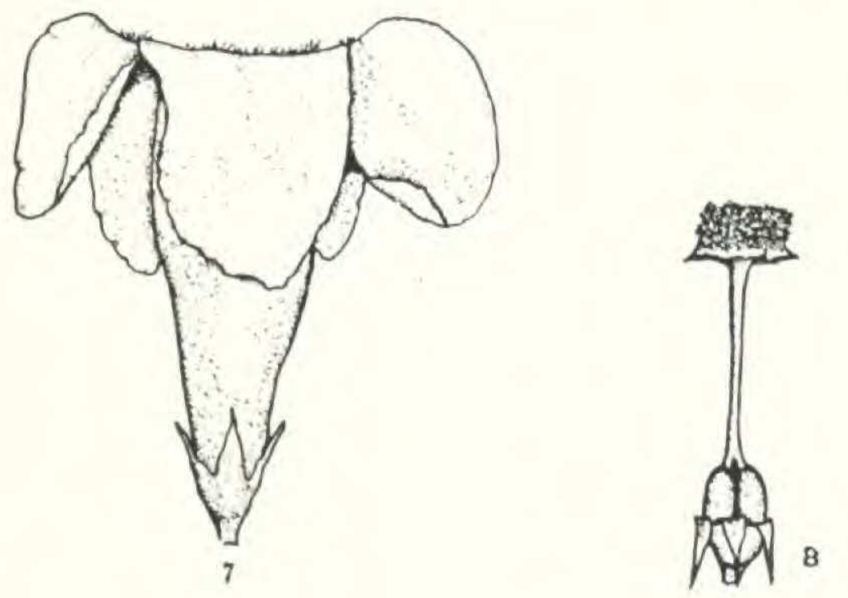
Fig. 9. Flower.
Fig. 10. Pistil.

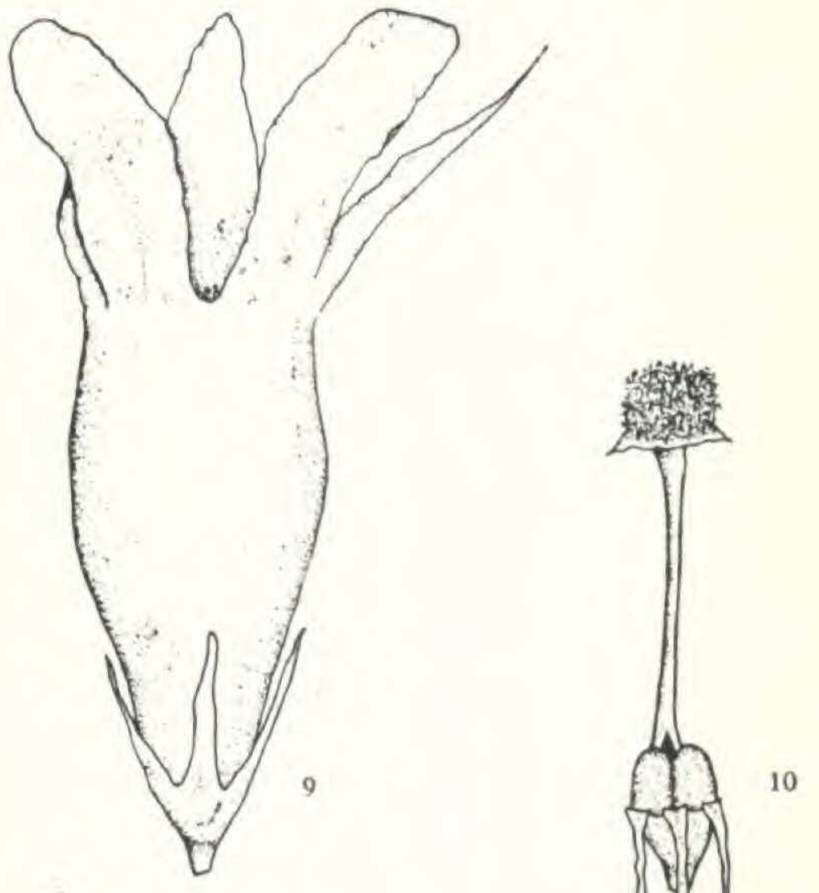
A. Tabernaemontana Walt.

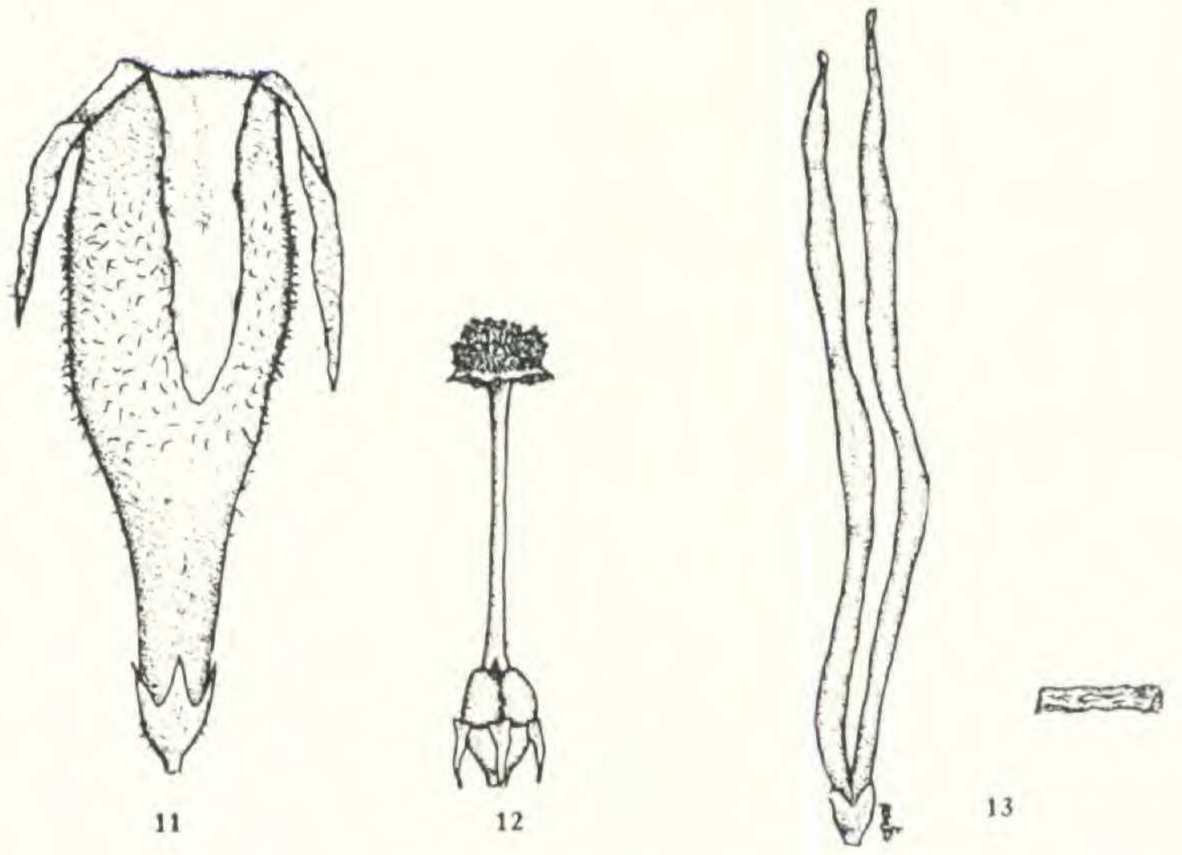
Fig. 11. Flower.
Fig. 12. Pistil.
Fig. 13. Follicles and seed. × ¼.











WOODSON—STUDIES IN APOCYNACEAE

Explanation of Plate

PLATE 52

Illustrations of the subgenus *Sphinctosiphon;* all figures ×2 except when otherwise noted.

A. Palmeri Gray.

Fig. 14. Flower.
Fig. 15. Pistil.

A. Standleyi Woodson.

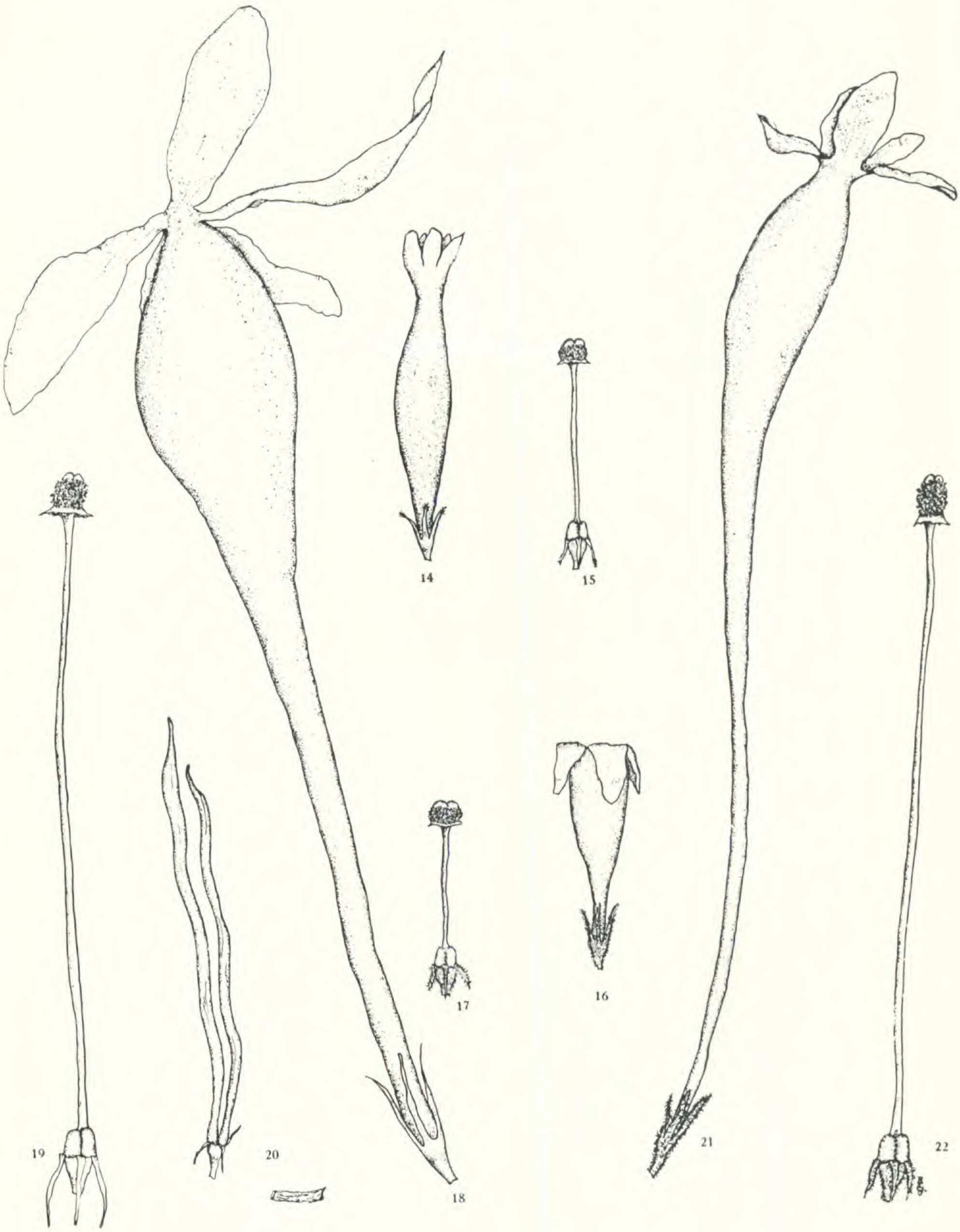
Fig. 16. Flower.
Fig. 17. Pistil.

A. longiflora Torr.

Fig. 18. Flower.
Fig. 19. Pistil.
Fig. 20. Follicles and seed. × ¼.

A. salpignantha Woodson.

Fig. 21. Flower.
Fig. 22. Pistil.


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Explanation of Plate

PLATE 53

Illustrations of the subgenus *Articularia;* all figures × 2 except when otherwise noted.

A. tomentosa Torr. & Frém.

Fig. 23. Flower.
Fig. 24. Pistil.
Fig. 25. Follicles and seed. × ½.

A. brevifolia Gray.

Fig. 26. Flower.
Fig. 27. Pistil.
Fig. 28. Follicles and seed. × ½.

A. arenaria Standley.

Fig. 29. Flower.
Fig. 30. Pistil.